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AUTOMATIC TRANSMISSION SERVICE GROUP

INTRODUCTION
SPRINT SUZUKI

The SPRINT SUZUKI 3 SPEED automatic transaxle is electrically controlled, fully automatic transmission, it utilized a regular non lock-up hydraulic torque converter, two planetary gear sets, two multidisc clutch packs in drums, one multidisc clutch in the case and a one way clutch assembly. We have included the latest information on the **Geo Metro** full electric control for this transmission on the final pages of this manual.

We thank AISIN SEIKI for the illustrations and information that have made this booklet possible.

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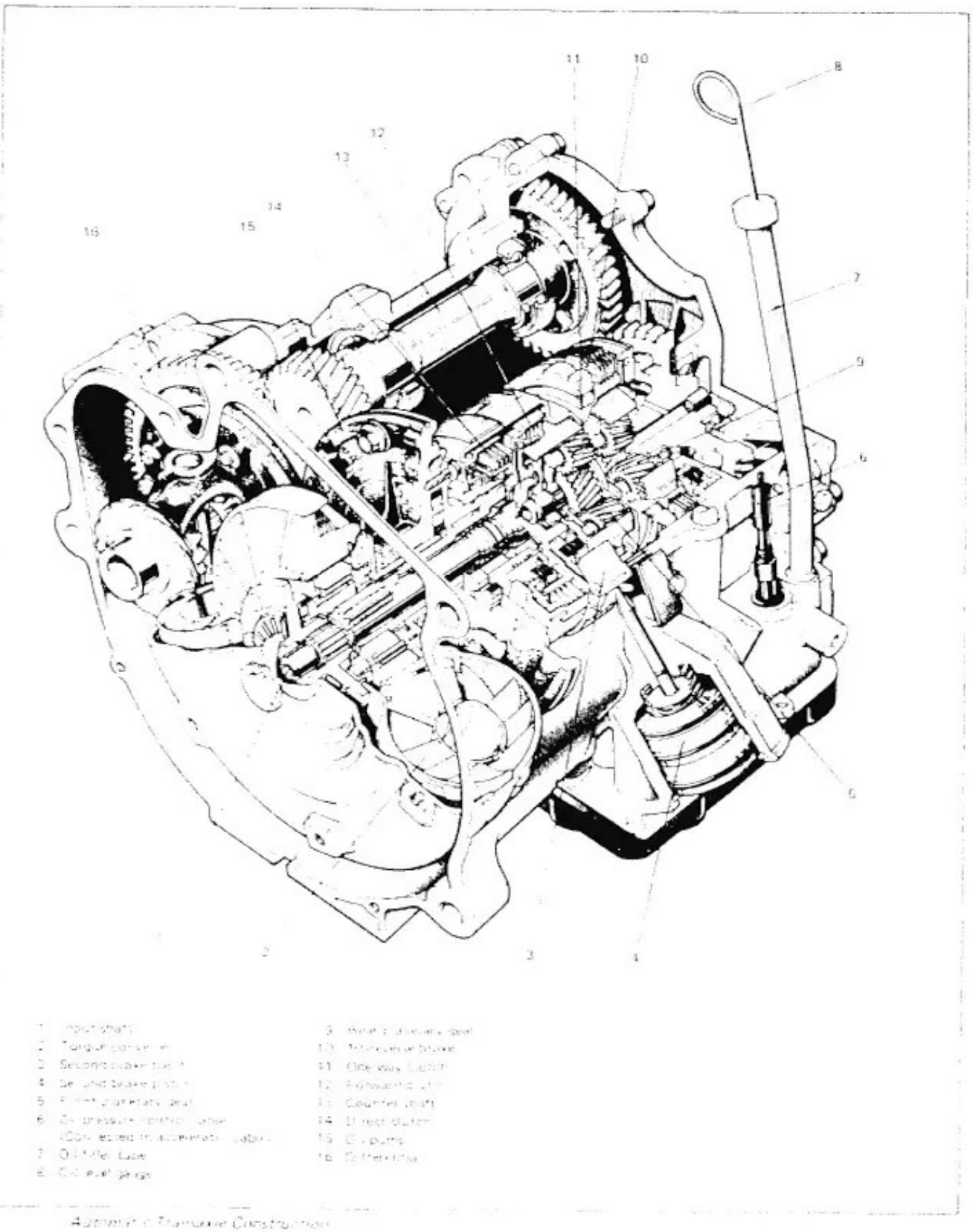
CONSTRUCTION AND FUNCTION



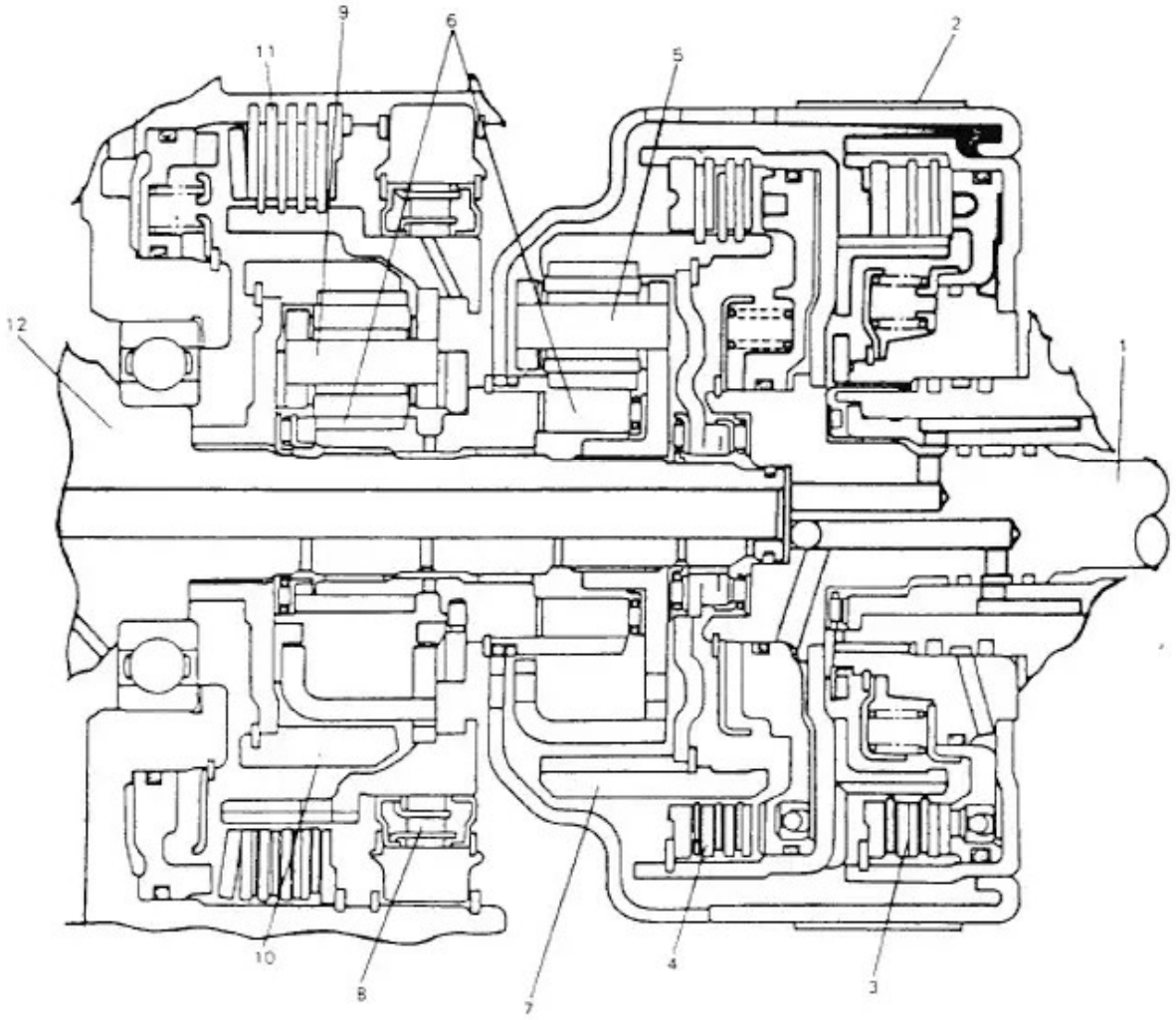
1 Input shaft
2 Torque converter
3 Second coaster brake
4 Oil pump drive shaft
5 Front planetary gear
6 Oil pressure control valve (Controlled by accumulator valve)
7 Oil filler tube
8 Oil level gauge
9 Inhibit switch seal
10 Transmission breather
11 One way clutch
12 Forward clutch
13 Countershaft
14 Direct clutch
15 Oil pump
16 Oil filter case

Automatic Transaxle Construction

PLANETARY GEAR UNITS

In this unit, the sun gear is mounted in its center and engaged with it are 4 pinion gears supported by a carrier. Then, the outer ring gear is engaged with them. Depending on gear combinations, revolution is changed in speed or direction.

Among the units which operate in connection with the planetary gear unit, there are a direct clutch, a second brake, a forward clutch, a one-way clutch and a 1st-reverse brake.



1 Input shaft
2 Second brake band
3 Direct clutch
4 Forward clutch
5 Front planetary gear
6 Sun gear
7 Front ring gear
8 One-way clutch
9 Rear planetary gear
10 Rear ring gear
11 1st-reverse brake
12 Output shaft

Planetary Gear Sets Cross Section

GENERAL DESCRIPTION

The automatic transaxle consists of the hydraulic torque converter, electronically controlled 3-speed automatic transmission, countershaft and differential.

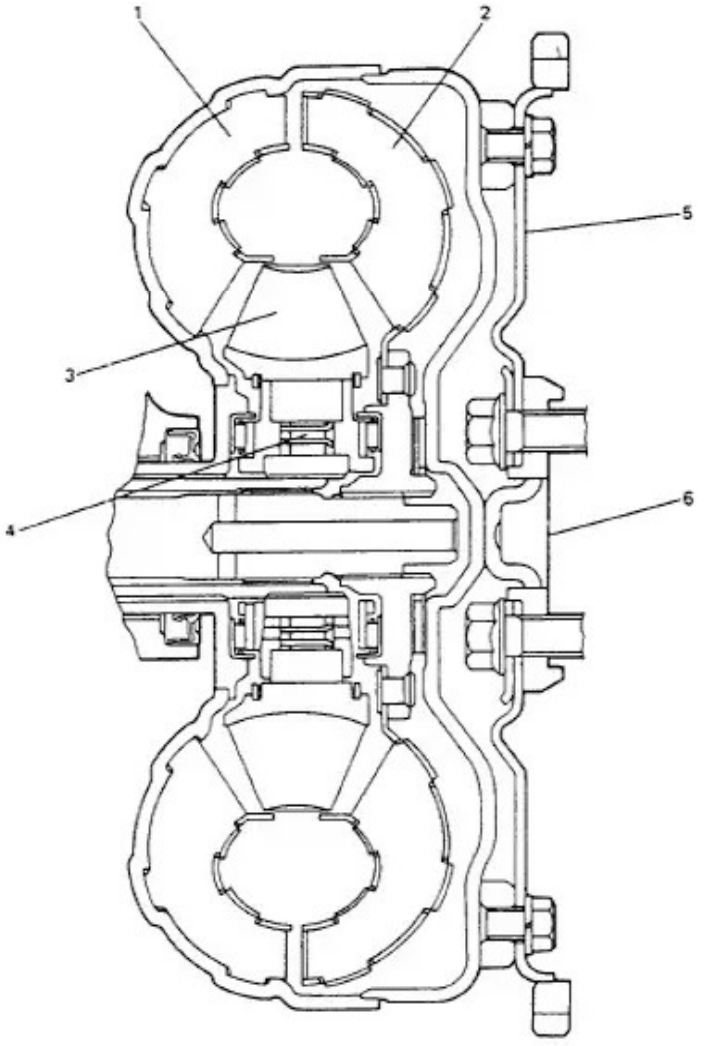
The transmission consists of 2 planetary gears, 2 disk clutches, 1 band brake, 1 disk brake and 1 one-way clutch. Its operation is controlled by selecting a position from 6 positions ("P", "R", "N", "D", "2" and "L") manually by means of the selector lever installed on the compartment floor.

In the "D" or "2" range, the gear ratio is changed for the 1st, 2nd or 3rd speed ("D" range only) automatically by electronic control.

TORQUE CONVERTER

The torque converter is of 3-element hydraulic type and consists of the pump, turbine and stator in a unit incapable of disassembly. The pump is mounted to the crankshaft, the turbine to the input shaft and the stator to the transmission case by way of the one-way clutch.

The torque converter, which increases torque when starting, accelerating and up-hill driving, functions as a fluid clutch while driving at a constant speed.

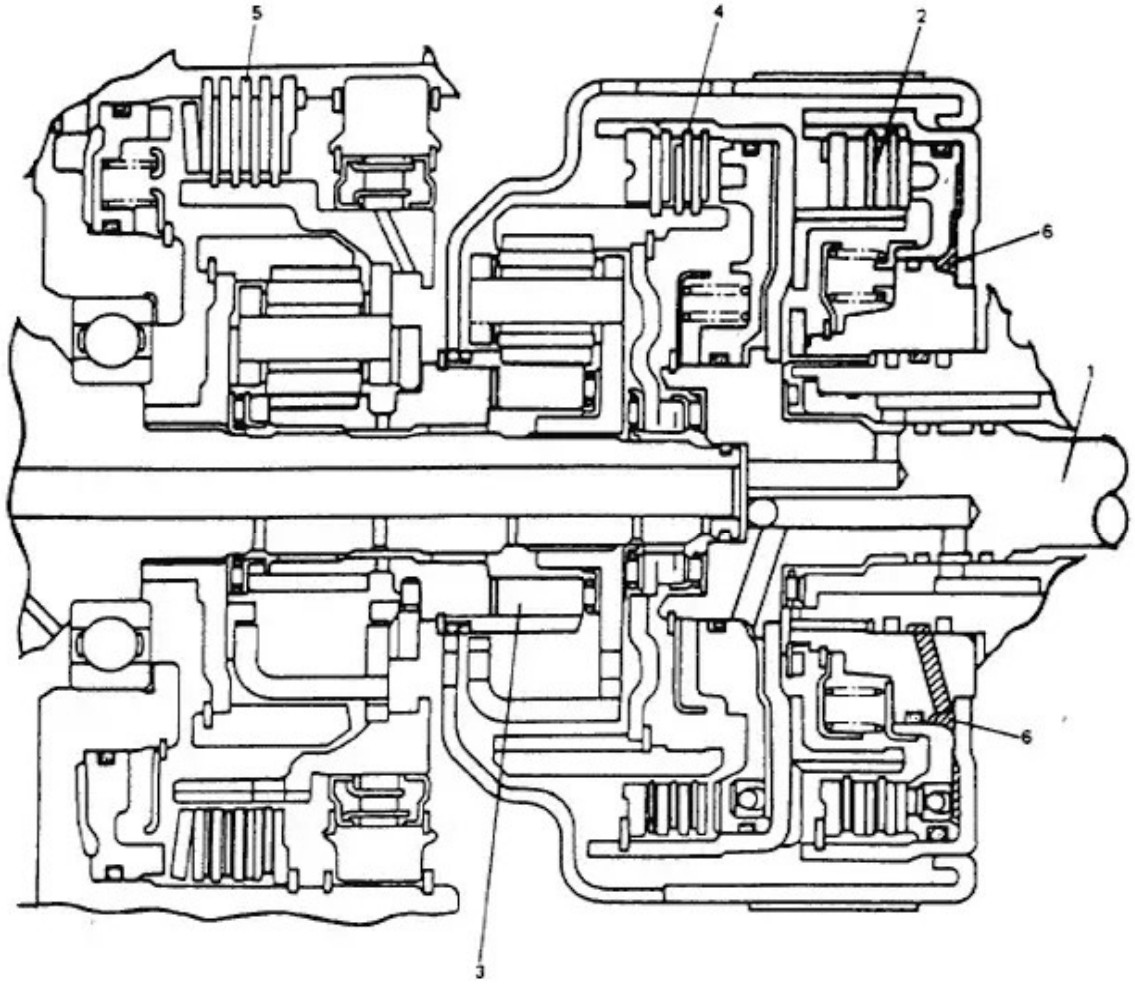


1. Pump
2. Turbine
3. Stator
4. One-way clutch
5. Drive plate
6. Crankshaft

Torque Converter Cross Section

DIRECT CLUTCH

The direct clutch connects the input shaft and the sun gear (common to both front and rear planetary gear units). It operates at the 3rd gear in the "D" range and in the "R" range. At the same time, the forward clutch operates in the former and the 1st-reverse brake in the latter.



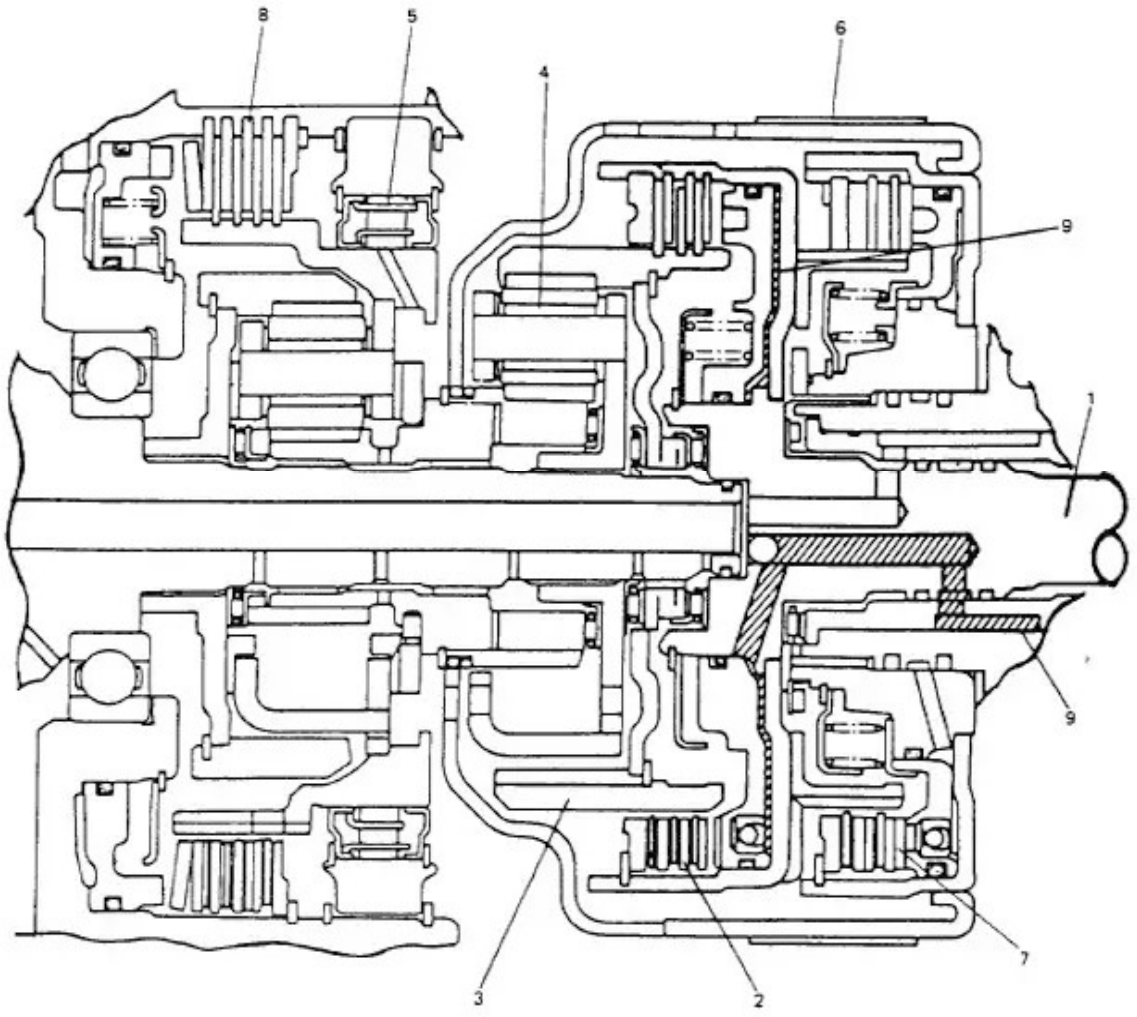
1. Input shaft
2. Direct clutch
3. Sun gear
4. Forward clutch
5. 1st-reverse brake
6. Oil pressure

Direct Clutch Cross Section

FORWARD CLUTCH

The forward clutch connects the input shaft and ring gear of the front planetary gear. It operates in the ranges other than "P", "R" and "N". The units which operate simultaneously with the forward clutch are as follows.

- One-way clutch at the 1st gear in "D" or "2" range.
- Second brake at the 2nd gear in "D" or "2" range.
- Direct clutch at the 3rd gear in "D" range.
- 1st-reverse brake at the 1st gear in "L" range.

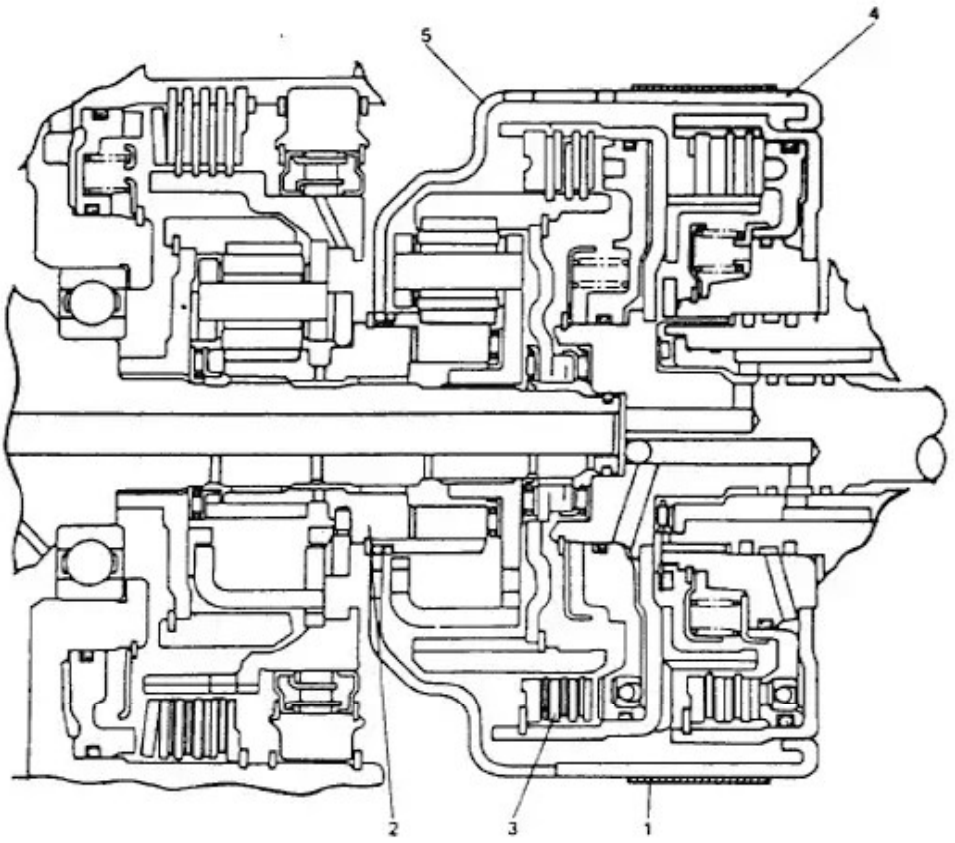


1. Input shaft
2. Forward clutch
3. Ring gear of front planetary gear
4. Front planetary gear
5. One-way clutch
6. Second brake band
7. Direct clutch
8. 1st-reverse brake
9. Oil pressure

Forward Clutch Cross Section

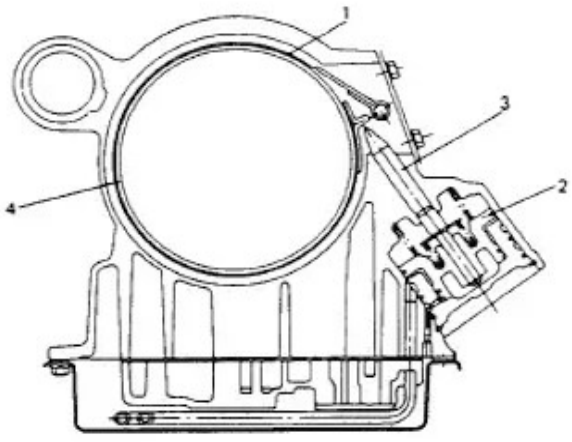
SECOND BRAKE

The second brake is of band type. It holds the sun gear of the front and rear planetary gear units stationary. It operates at the 2nd gear in "D" or "2" range simultaneously with the forward clutch.



1. Second brake band
2. Sun gear
3. Forward clutch
4. Direct clutch drum
5. Sun gear input drum

Second Brake Cross Section

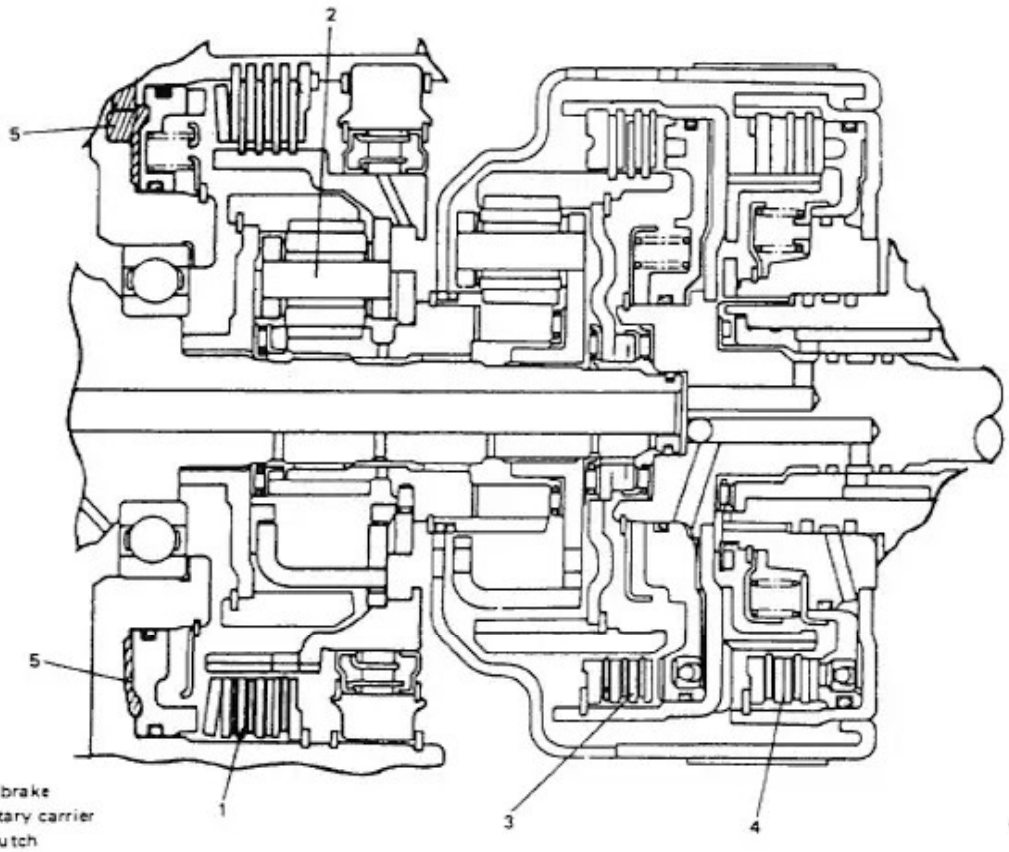


1. Second brake band
2. Second brake piston
3. Second brake piston rod
4. Direct clutch drum

Second Brake Piston Cross Section

FIRST & REVERSE BRAKE

The 1st-reverse brake holds the rear planetary carrier stationary. It operates in "L" or "R" range. At the same time, the forward clutch operates in "L" range and the direct clutch in "R" range.

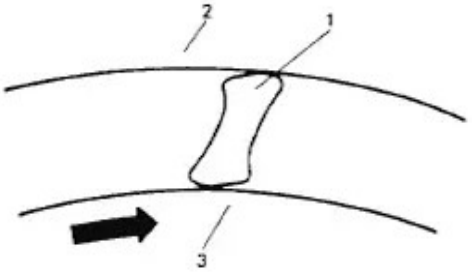


1. 1st-reverse brake
2. Rear planetary carrier
3. Forward clutch
4. Direct clutch
5. Oil pressure

First & Reverse Brake Cross Section

ONE- WAY CLUTCH

The sprag type one-way clutch is used between the rear planetary carrier and the transmission case. It consists of a one-way clutch race, sprags and a retainer, and the one-way clutch race is mounted to transmission case. When the rear planetary carrier is in motion to turn to arrow mark side at the first gear in "D" or "2" range, the sprags stick between carrier and race, and prevent the planetary carrier from turning reversely (to arrow mark side).



1. Sprag
2. One-way clutch race (fixed to transmission case)
3. Rear planetary carrier

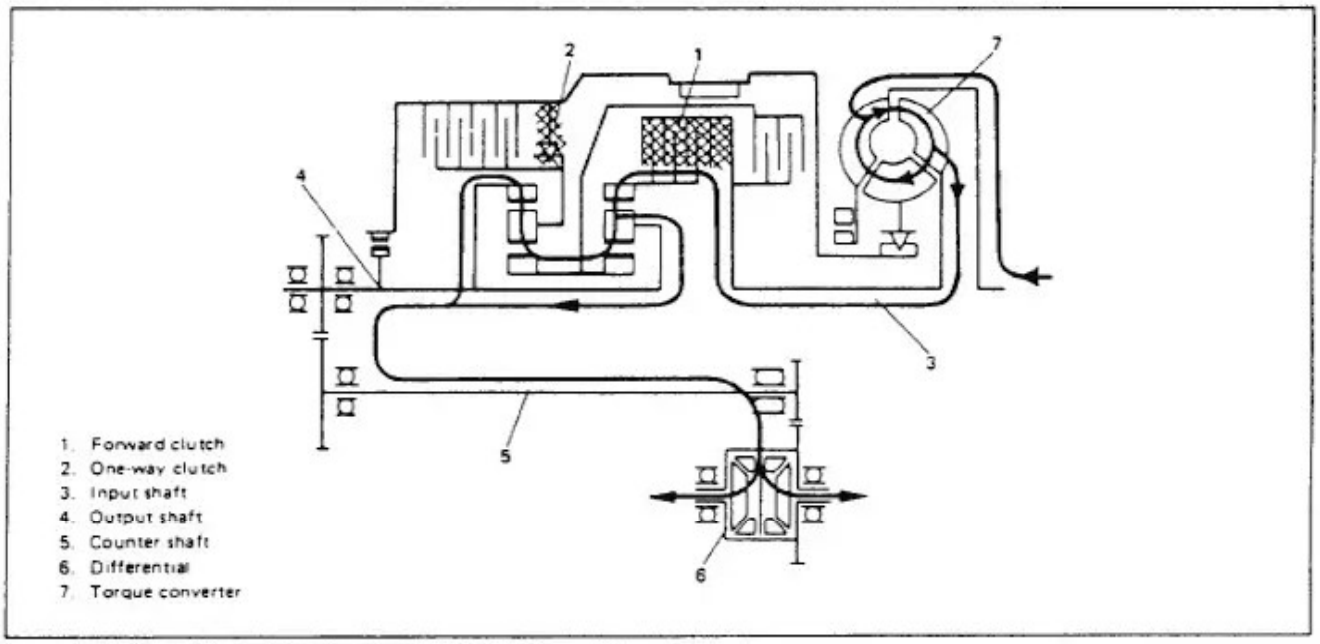
One-Way Clutch

POWER FLOW

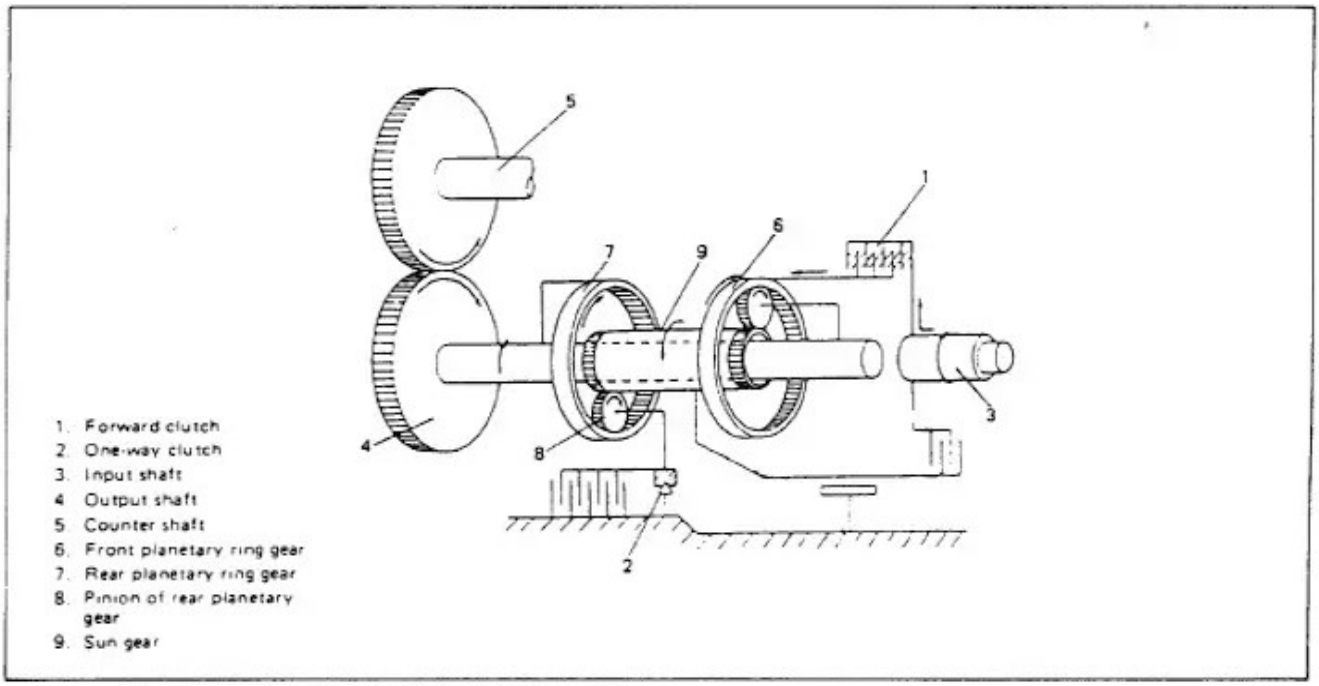
1st Gear in "D" or "2" Range

As oil pressure is applied to the forward clutch, the input shaft and the front planetary ring gear are engaged. This allows the clockwise revolution of the input shaft to be transmitted directly to the ring gear and then through the front planetary carrier to the output shaft.

On the other hand, the sun gear which is engaged with the pinion gears of the front planetary gear turns counterclockwise. As this revolution is transmitted to the pinions of the rear planetary gear, the rear planetary carrier would also turn counterclockwise. However, being held by the one-way clutch, it cannot turn. Consequently, the pinions turn clockwise on their axes and this causes the ring gear of the rear planetary gear and output shaft to turn clockwise.



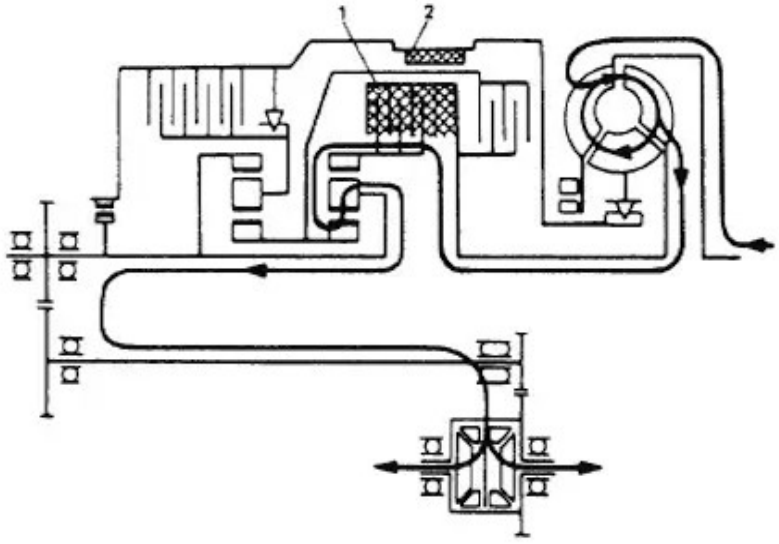
Power Flow of 1st Gear in "D" or "2" Range (1)



Power Flow of 1st Gear in "D" or "2" Range (2)

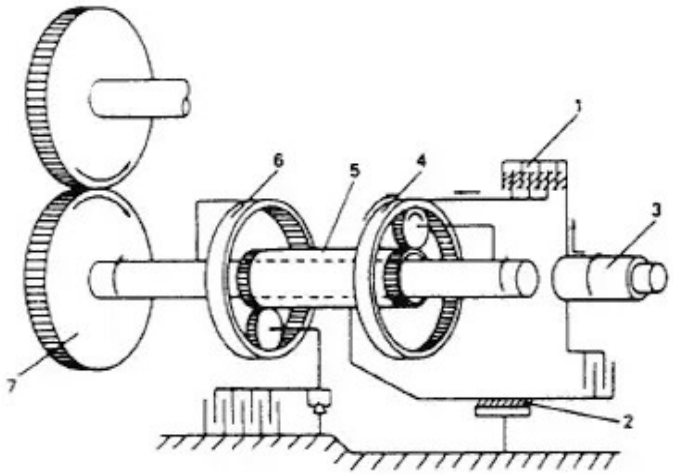
2nd Gear in "D" or "2" Range

As oil pressure is applied to the forward clutch, the input shaft and the ring gear of the front planetary gear are engaged. This allows the revolution of the input shaft to be transmitted directly to the ring gear, causing the front planetary carrier to turn clockwise. In this state, the sun gear, being engaged with the pinions of the front planetary gear, would turn counterclockwise. However, the second brake is in operation and prevents it from turning. As a result, the pinions of the front planetary gear turn around the sun gear. Therefore, the front planetary ring gear and then the output shaft turn clockwise.



1. Forward clutch
2. Second brake

Power Flow of 2nd Gear in "D" or "2" Range (1)

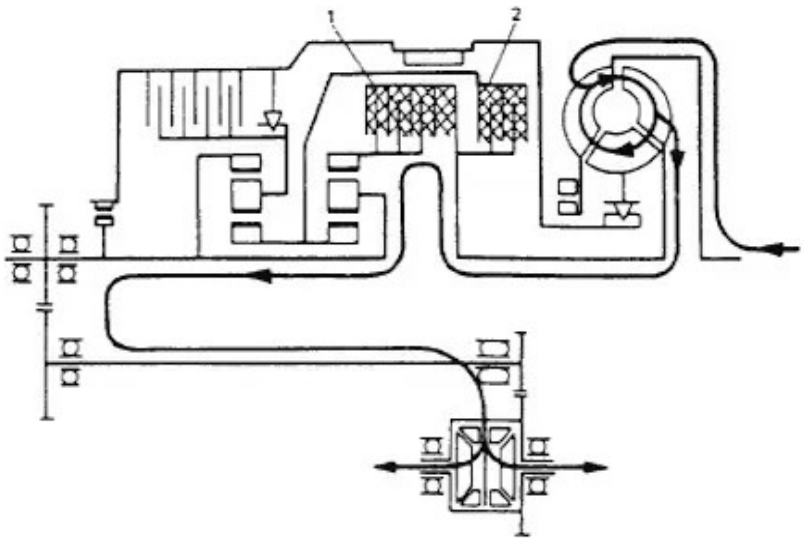


1. Forward clutch
2. Second brake
3. Input shaft
4. Front planetary ring gear
5. Sun gear
6. Rear planetary ring gear
7. Output shaft

Power Flow of 2nd Gear in "D" or "2" Range (2)

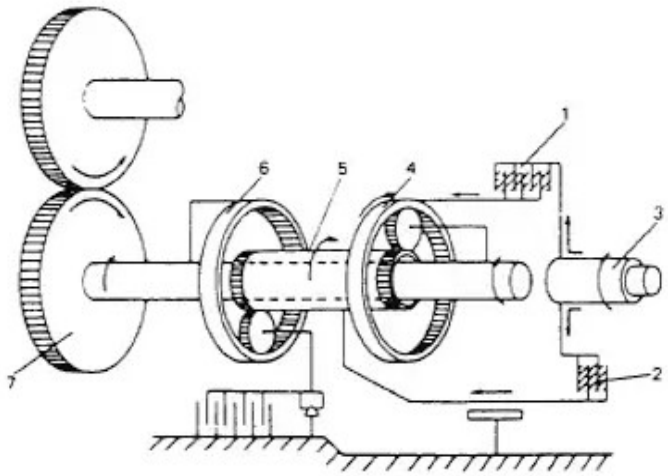
3rd Gear in "D" Range

As oil pressure is applied to the forward clutch and the direct clutch, the input shaft is engaged with the ring gear and the sun gear of the front planetary gear. In other words, the input shaft is directly connected to the planetary gear unit itself. As a result, the pinions of the planetary gear are locked and thus the input shaft revolution is transmitted directly to the output shaft.



1. Forward clutch
2. Direct clutch

Power Flow of 3rd Gear in "D" Range (1)

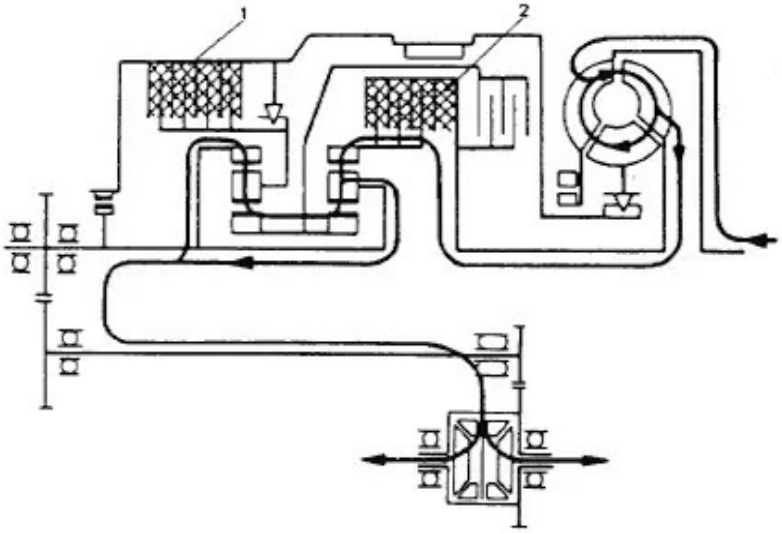


1. Forward clutch
2. Direct clutch
3. Input shaft
4. Front planetary ring gear
5. Sun gear
6. Rear planetary ring gear
7. Output shaft

Power Flow of 3rd Gear in "D" Range (2)

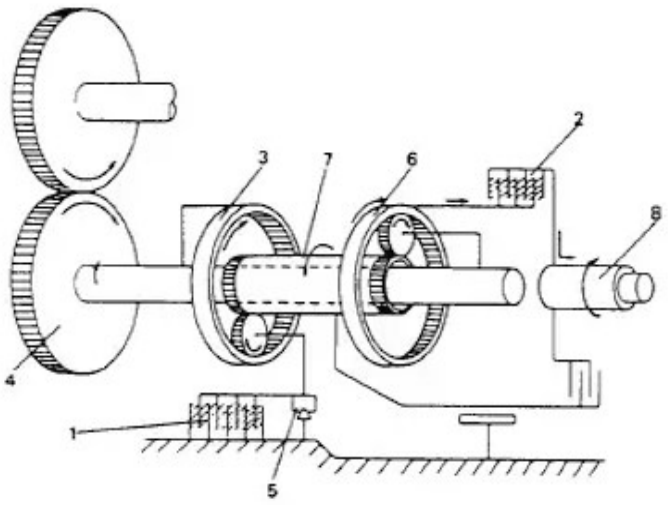
"L" Range

The torque flow from the engine is the same as at the 1st gear in "D" or "2" range, but in this range, the 1st-reverse brake is put into operation to prevent the rear planetary carrier from clockwise revolution which occurs when engine brake is applied. In other words, when driving in "D" or "2" range, the counterclockwise revolution of the rear planetary carrier is stopped by means of the one-way clutch, but when the engine brake is applied, the torque (clockwise) from the output shaft acts to prevent the one-way clutch from operating and the rear planetary carrier idles. This puts the 1st-reverse brake into operation so as to hold the rear planetary carrier stationary. Thus a engine braking force is provided.



1. 1st-reverse brake
2. Forward clutch

"L" Range Power Flow (1)

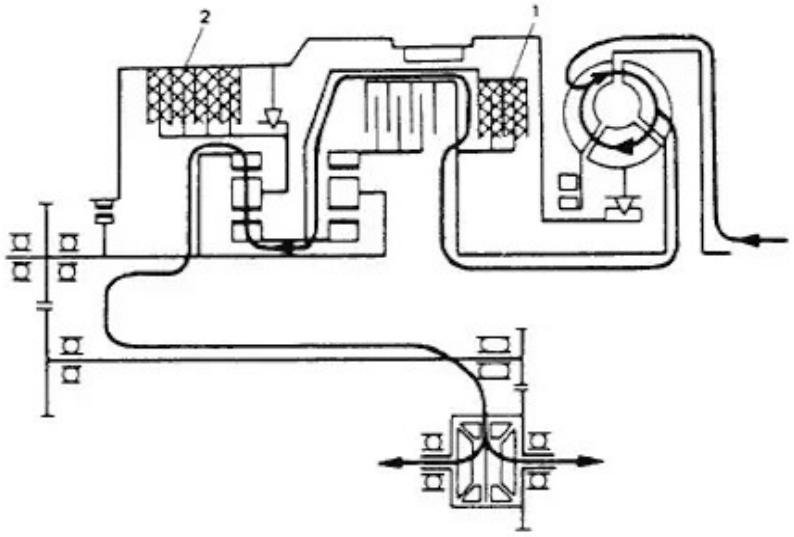


1. 1st-reverse brake
2. Forward clutch
3. Rear planetary ring gear
4. Output shaft
5. One-way clutch
6. Front planetary ring gear
7. Sun gear
8. Input shaft

"L" Range Power Flow (2)

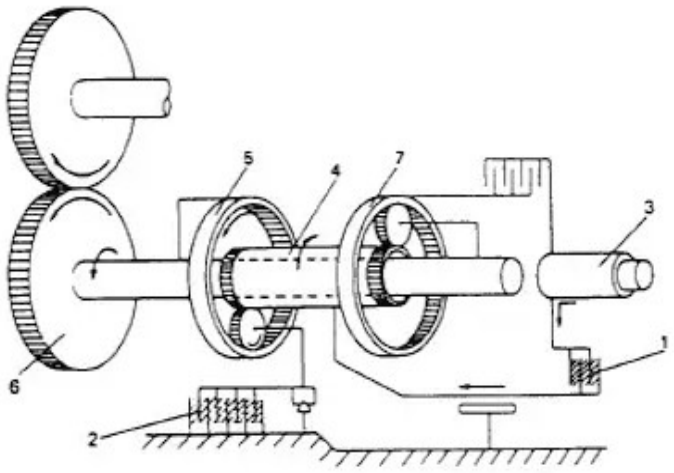
"R" Range

As oil pressure is applied to the direct clutch, the input shaft is engaged with the sun gear of the planetary gear. This allows the torque to be transmitted directly from the input shaft to the sun gear. On the other hand, the 1st-reverse brake is also at work and therefore the rear planetary carrier is held stationary. In this state, the pinions do not turn around the sun gear but turn around counterclockwise on their axes and cause the ring gear to turn counterclockwise. As the output shaft is spline fitted to the rear planetary ring gear, it also turns counterclockwise, thereby the car moves rearward.



1. Direct clutch
2. 1st-reverse brake

"R" Range Power Flow (1)

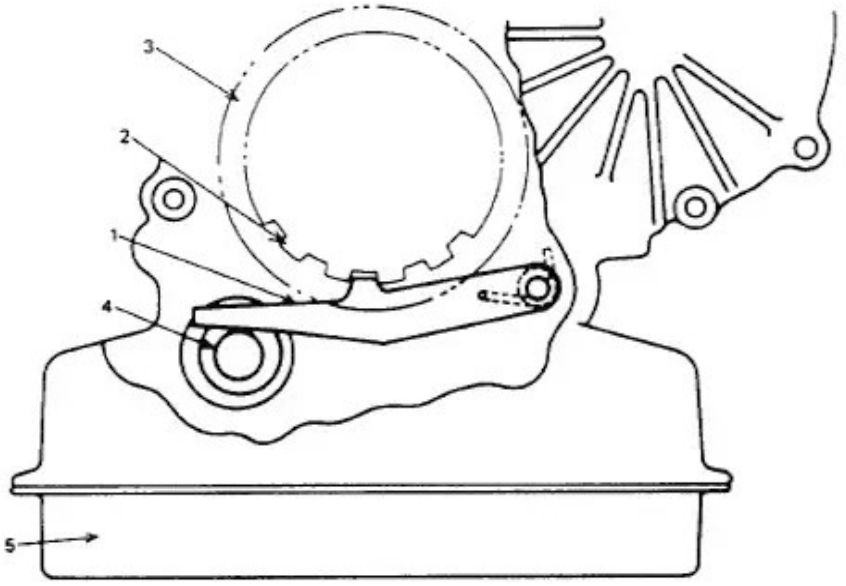


1. Direct clutch
2. 1st-reverse brake
3. Input shaft
4. Sun gear
5. Rear planetary ring gear
6. Output shaft
7. Front planetary ring gear

"R" Range Power Flow (2)

"N" or "P" Range

As the forward clutch and direct clutch are released, the engine torque is not transmitted from the input shaft to the output shaft. In "P" range, the parking lock pawl is engaged with the parking lock gear which is incorporated with the drive gear of the output shaft and thus the front wheels are mechanically locked.



1. Parking lock pawl
2. Parking lock gear
3. Output shaft drive gear
4. Parking lock pawl sleeve
5. Oil pan

"P" Range

Components Operation Chart

Range	Gear	Forward Clutch	Direct Clutch	Second Brake	1st & Reverse Brake	One-way Clutch	Parking Lock Pawl
P	Parking	–	–	–	**○	–	○
R	Reverse	–	○	–	○	–	–
N	Neutral	–	–	–	–	–	–
D	1st	○	–	–	–	○	–
	2nd	○	–	○	–	–	–
	3rd	○	○	–	–	–	–
2	1st	○	–	–	–	○	–
	2nd	○	–	○	–	–	–
L	1st	○	–	–	○	○	–
	*2nd	○	–	○	–	–	–

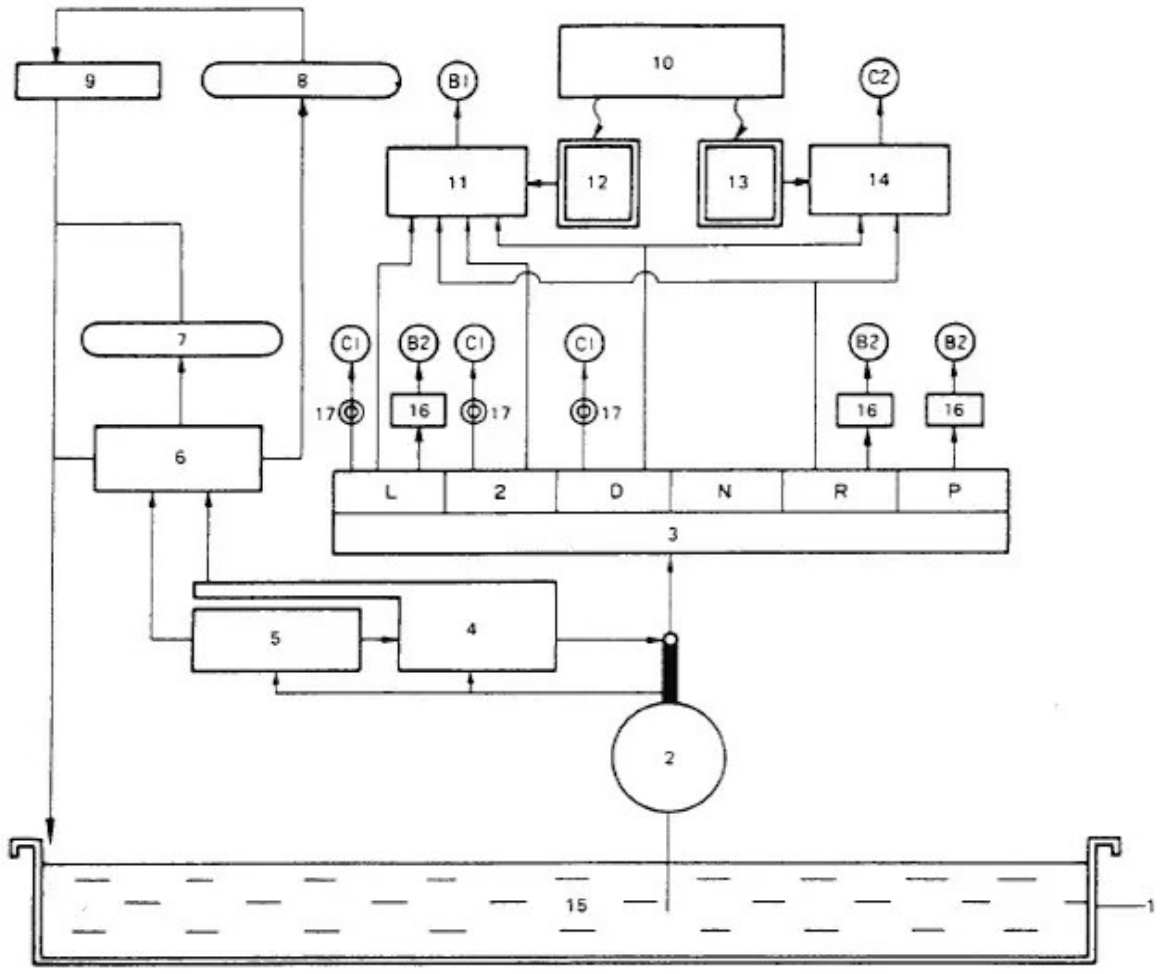
○ : Operated

* : To prevent overrevolution of engine, this 2nd gear is operated only when selector lever is shifted to "L" range at the speed of more than 53 km/h (33 mile/h).

** : When engine is running.

OIL PRESSURE CONTROL SYSTEM

The oil pressure control system fundamentally consists of three parts: (1) oil pressure producing system which consists of an oil pump to produce oil pressure and regulator valve to regulate the pressure, (2) oil circuit to feed oil into the torque converter, the oil cooler and the transmission components to be lubricated, and (3) control system to shift the gear of the planetary gear unit by acting on each clutch and brake.



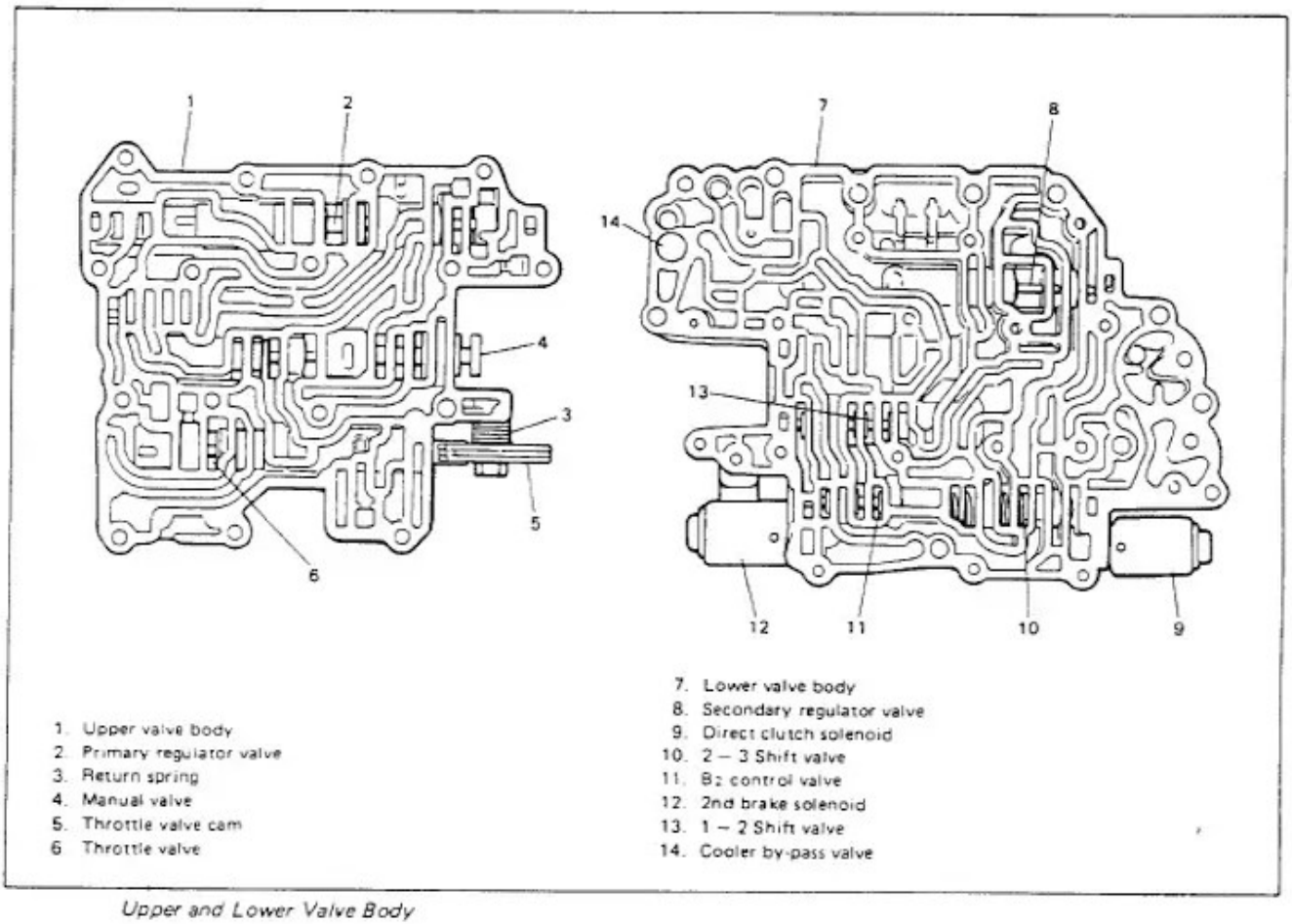
1. Oil pan
2. Oil pump
3. Manual valve
4. Primary regulator valve
5. Throttle valve
6. Secondary regulator valve
7. Lubrication
8. Torque converter
9. Oil cooler
10. Controller (Computor)
11. 1 – 2 Shift valve
12. Second (2nd) brake solenoid
13. Direct clutch solenoid
14. 2 – 3 Shift valve
15. Oil (fluid)
16. B2 control valve
17. Accumulator

C1. Forward clutch
C2. Direct clutch
B1. Second (2nd) brake
B2. 1st-reverse brake

Oil Pressure Control System Diagram

Valve Body

The valve body is installed in the oil pan and has valves to control oil pressure. In the valve body, oil passages connect valves.

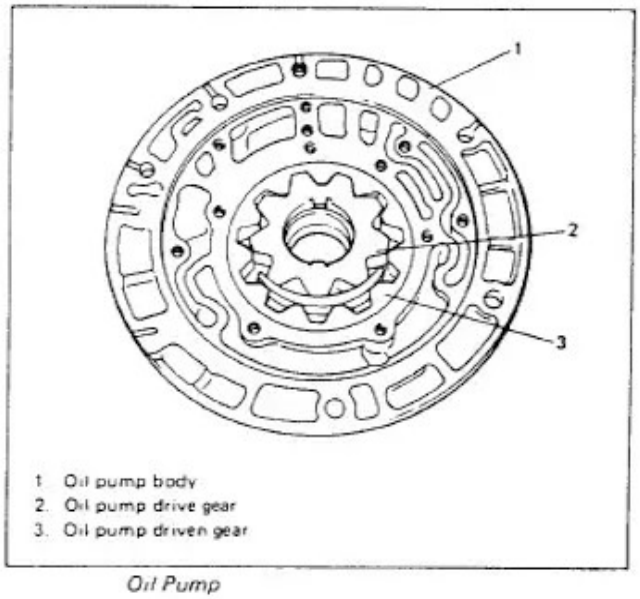


1. Upper valve body
2. Primary regulator valve
3. Return spring
4. Manual valve
5. Throttle valve cam
6. Throttle valve
7. Lower valve body
8. Secondary regulator valve
9. Direct clutch solenoid
10. 2 – 3 Shift valve
11. B_2 control valve
12. 2nd brake solenoid
13. 1 – 2 Shift valve
14. Cooler by-pass valve

Upper and Lower Valve Body

Oil Pump

The oil pump is of the internal gear type. It feeds oil to the torque converter, lubricates each part of the transmission and delivers oil pressure to operate each clutch and brake. The oil pump is driven together with the pump impeller by the engine.



1. Oil pump body
2. Oil pump drive gear
3. Oil pump driven gear

Oil Pump

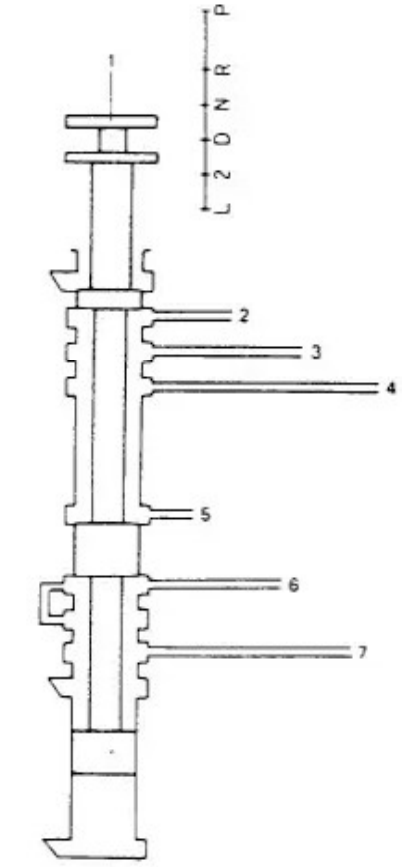
Manual Valve

The manual valve is directly connected with the selector lever by wire. It opens and closes the oil passage mechanically so as to form respective oil pressure circuit for "L", "2", "D", "N", "R", or "P" range according to the selector lever movement.

Throttle Valve

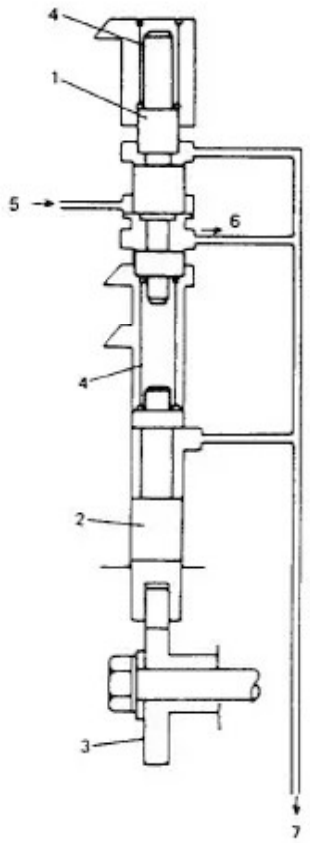
As the throttle valve is linked with the accelerator pedal by wire, it produces the throttle pressure corresponding to the extent to which the accelerator pedal is depressed which is, in other words, the engine output.

When the accelerator pedal is depressed, the throttle cam pushes the shift plug which then compresses two springs to move the throttle valve. Thus the line pressure passage is opened and the throttle pressure is produced. The throttle pressure is also applied to the back of the throttle valve to push back the valve. The throttle pressure is determined by the tensile force of the springs (position of the shift plug) and applied to the primary and secondary regulator valves to regulate the line pressure.



1. Manual valve
2. To 2 – 3 shift valve
3. To 1 – 2 shift valve
4. To forward clutch
5. From primary regulator valve and oil pump
6. To 1 – 2 shift valve and B_2 control valve
7. To 2 – 3 shift valve and primary regulator valve

Manual Valve

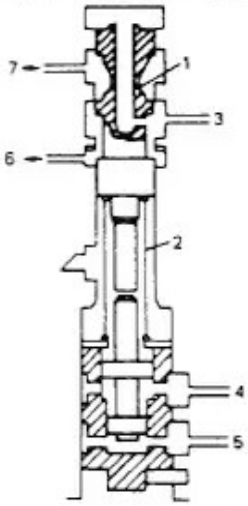


1. Throttle valve
2. Shift plug
3. Throttle valve cam
4. Spring
5. Line pressure (from oil pump)
6. Throttle pressure
7. To primary and secondary regulator valves

Throttle Valve

Primary Regulator Valve

This valve regulates the oil pressure produced by the oil pump (line pressure) to correspond to each condition of use. It is operated by the throttle pressure, line pressure when in reverse and the springs.

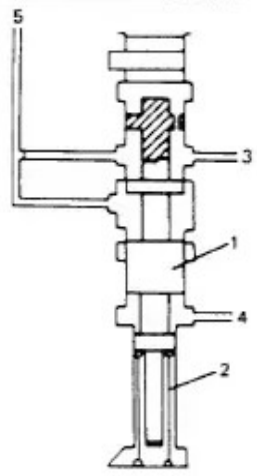


1. Primary regulator valve
2. Spring
3. Line pressure
4. Line pressure in "R" range
5. Throttle pressure
6. To secondary regulator valve
7. Drain

Primary Regulator Valve

Secondary Regulator Valve

This valve regulates the oil pressure to the torque converter and lubricating oil pressure to each part of the transmission by means of the throttle pressure and the spring.

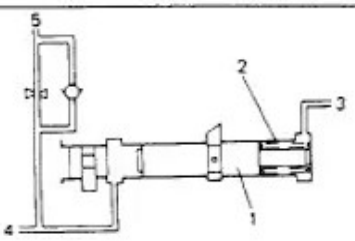


1. Secondary regulator valve
2. Spring
3. To torque converter
4. Throttle pressure
5. Lubrication

Secondary Regulator Valve

B_2 Control Valve

When in "L" range, this valve controls the line pressure acting on the 1st-reverse brake to reduce a shock.

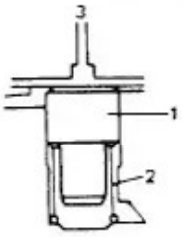


1. B_2 control valve
2. Spring
3. To 2 – 3 shift valve
4. To 1st-reverse brake
5. To 1 – 2 shift valve

B_2 Control Valve

Cooler By-pass Valve

This valve is provided to keep the oil pressure in the torque converter constant.

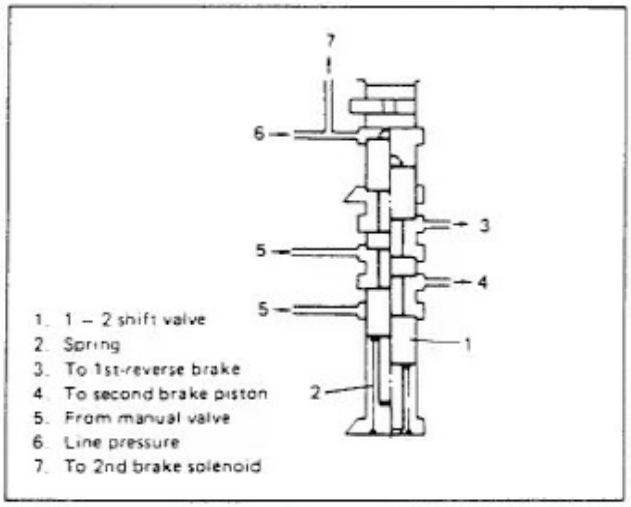


1. Cooler by-pass valve
2. Spring
3. To torque converter

Cooler By-pass Valve

1–2 Shift Valve

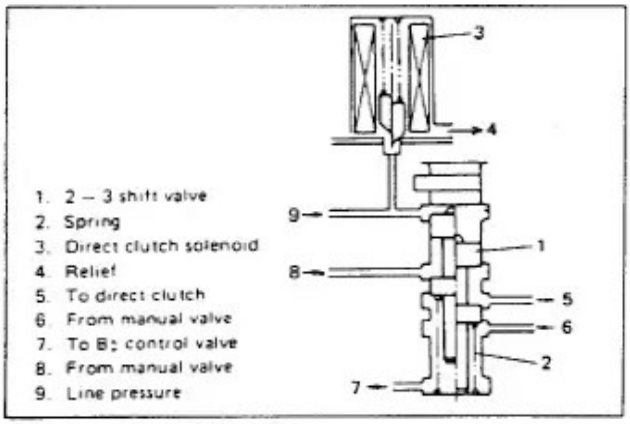
This valve carries out the gear shift between 1st and 2nd gears. When the 2nd brake solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the 2nd brake and thus the transmission is shifted into 2nd gear.
When the oil pressure to the 2nd brake solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 1st gear.
In "L" or "R" range, the oil pressure is applied to the 1st-reverse brake when the 2nd brake solenoid operates.



1 – 2 Shift valve

2–3 Shift Valve

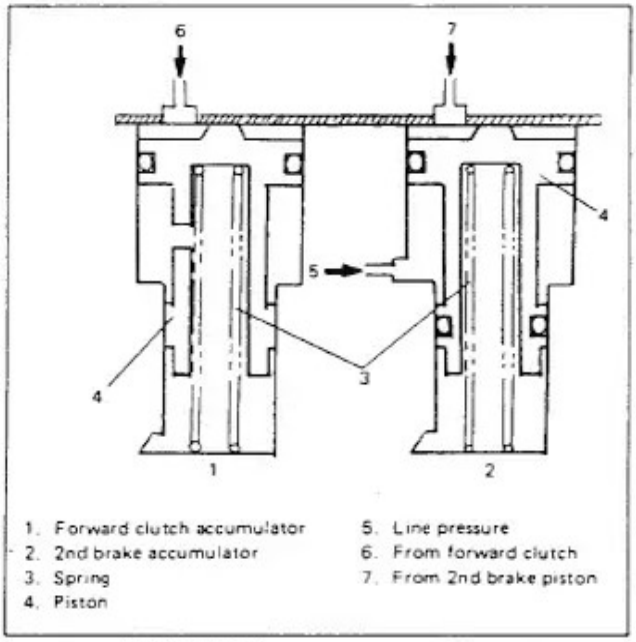
This valve carries out the gear shift between 2nd and 3rd gears. When the direct clutch solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the direct clutch and thus the transmission is shifted from the 2nd gear to the 3rd.
When the oil pressure to the solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 2nd gear.



2 – 3 Shift valve

Accumulator

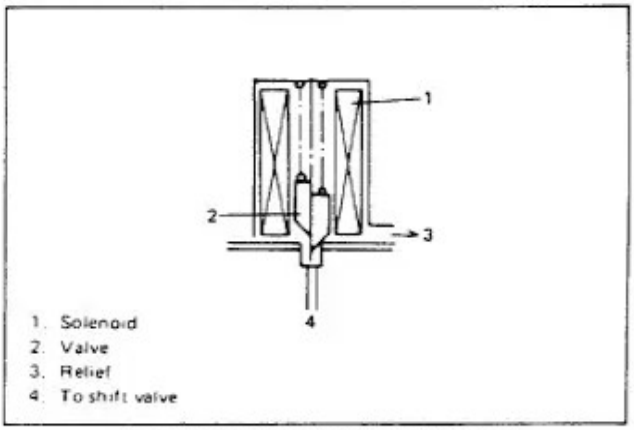
This serves to reduce a shock in each gear shift. There are two accumulators, one for the forward clutch and the other for the 2nd brake.



Accumulator

Direct Clutch and 2nd Brake Solenoids

These solenoids turn ON and OFF by the electric signals from the controller (computer). They serve to control the gear shift by operating the 1 – 2 and 2 – 3 shift valves. Direct clutch solenoid operates the 2 – 3 shift valve, and 2nd brake solenoid does the 1 – 2 shift valve. When the solenoid valve is ON, the valve moves up to relieve the line pressure and when OFF, the valve moves down and therefore the line pressure is applied to the shift valve.

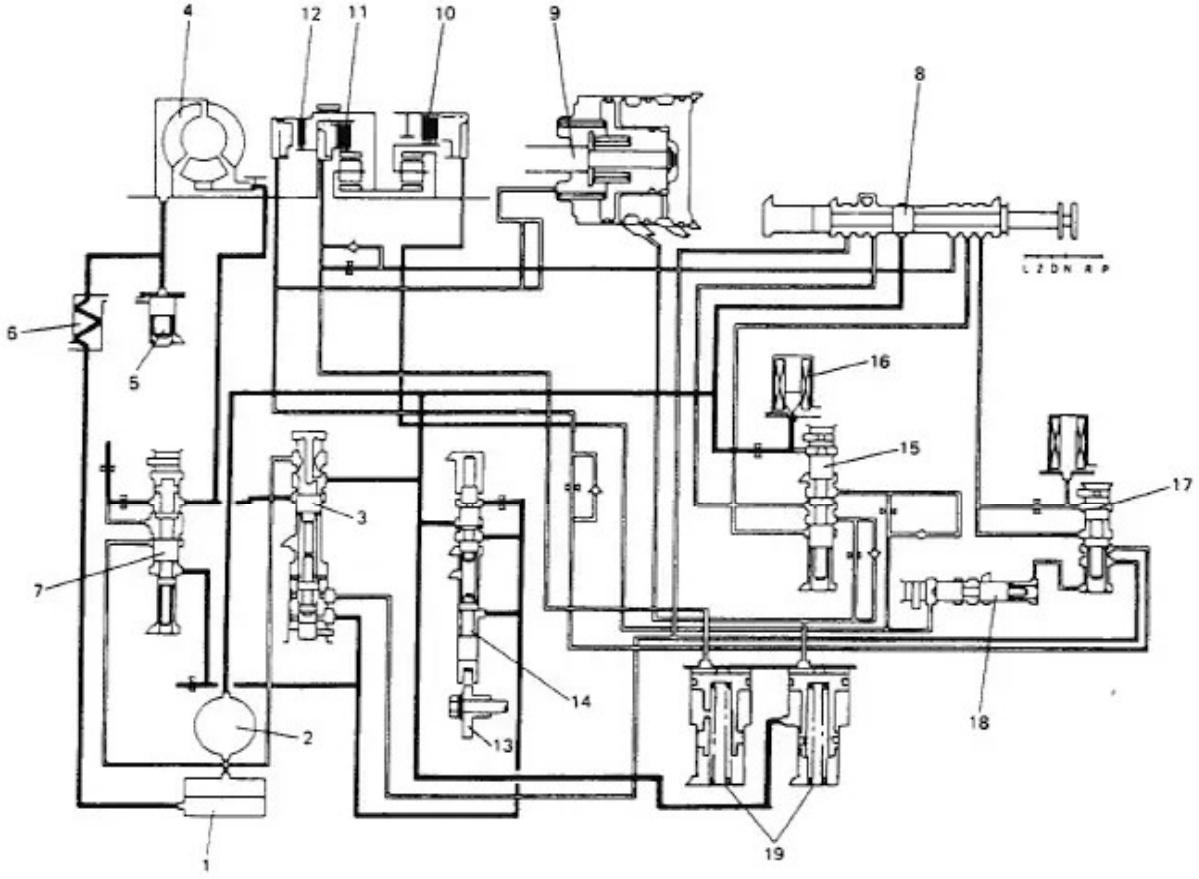


Direct Clutch and 2nd Brake Solenoids

Oil Circuit in "N" Range

When the engine is started and the oil pump starts to operate, oil in the oil pan passes through the oil pump, is regulated by the primary regulator valve and sent to the torque converter. Also, the oil which is further regulated by the secondary regulator valve lubricates each part of the transmission.

In this range, the oil pressure is not applied to any clutch or brake as the line pressure from the regulator valve is stopped by means of the manual valve.



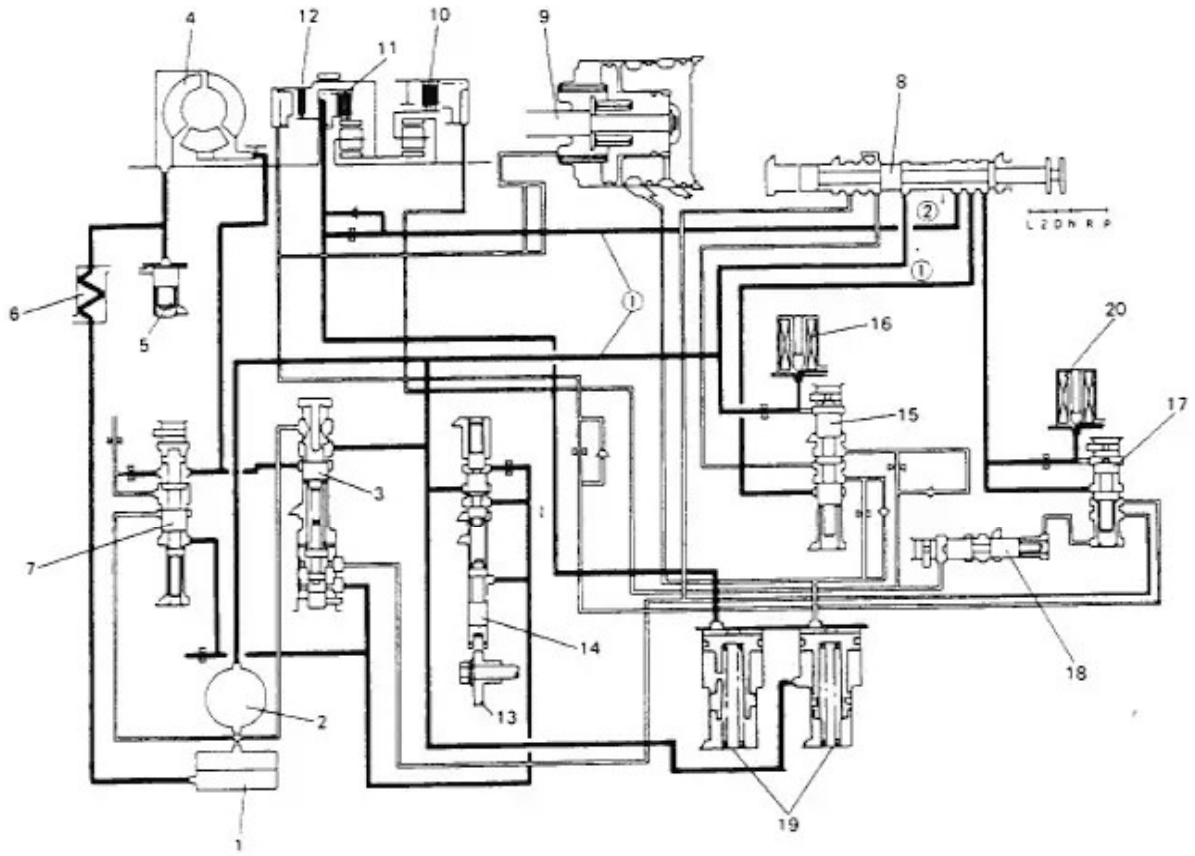
1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reverse brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B_2 control valve
19. Accumulator

Oil Circuit in "N" Range

Oil Circuit in "D" or "2" Range (1st Gear)

The line pressure which has passed through the manual valve is applied directly to the forward clutch. As this causes the clutch to be engaged, the 1st gear is shifted. The line pressure is also applied to the accumulator to reduce shocks at the time of clutch engagement.

As the direct clutch and the 2nd brake solenoids receive the electric signal from the controller, that is, they are turned ON, they relieve the line pressure. Therefore, neither the 1 – 2 nor 2 – 3 shift valve operates due to no oil pressure.



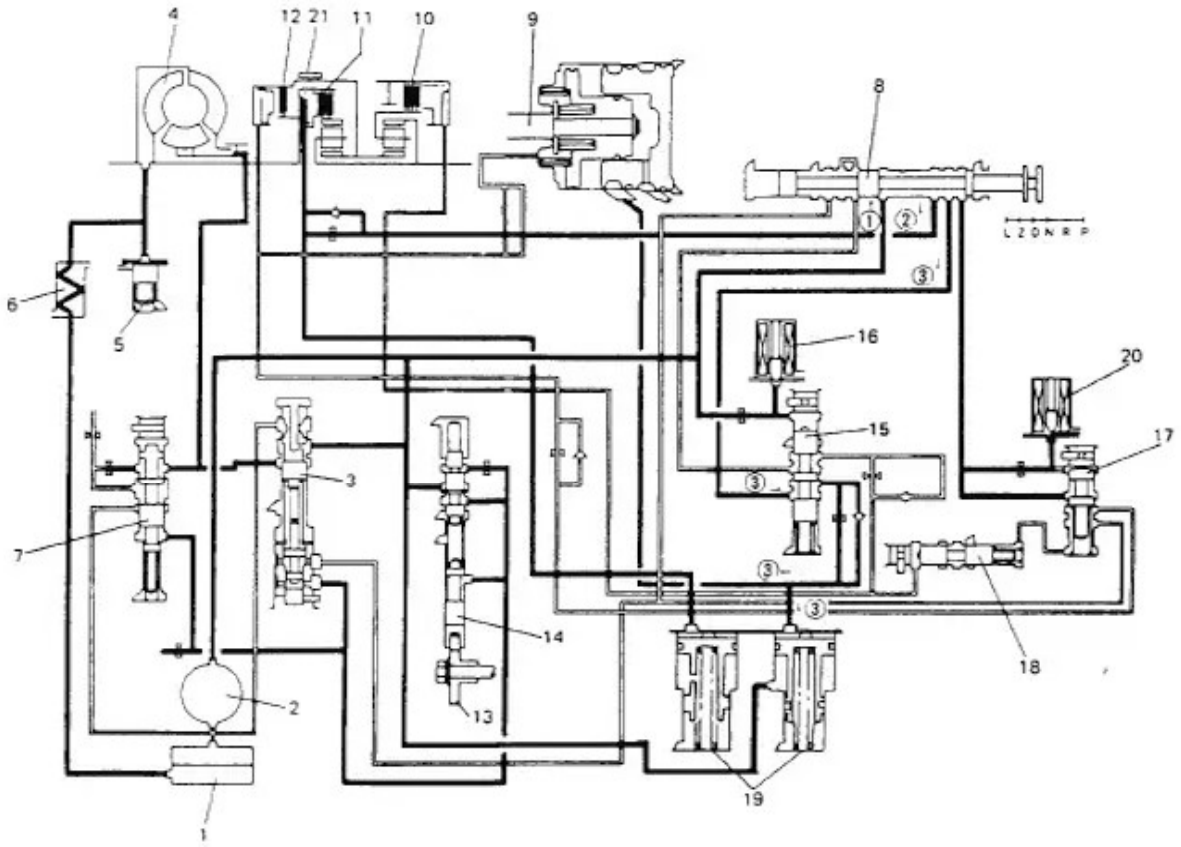
1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reverse brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B_2 control valve
19. Accumulator
20. Direct clutch solenoid

①, ② : Line pressure

Oil Circuit in "D" or "2" Range (1st Gear)

Oil Circuit in "D" or "2" Range (2nd Gear)

As the car speed is accelerated at the 1st gear and reaches the 2nd gear shift point, the 2nd brake solenoid turns OFF and closes the relief circuit. This causes the line pressure ① to act on the 1 – 2 shift valve. Then the valve moves to allow the line pressure ③ to be applied to the 2nd brake and the 2nd gear is attained. At this time, the line pressure ③ is also applied to the accumulator to reduce a shock occurring when the 2nd brake works.



1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reverse brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B2 control valve
19. Accumulator
20. Direct clutch solenoid
21. 2nd brake

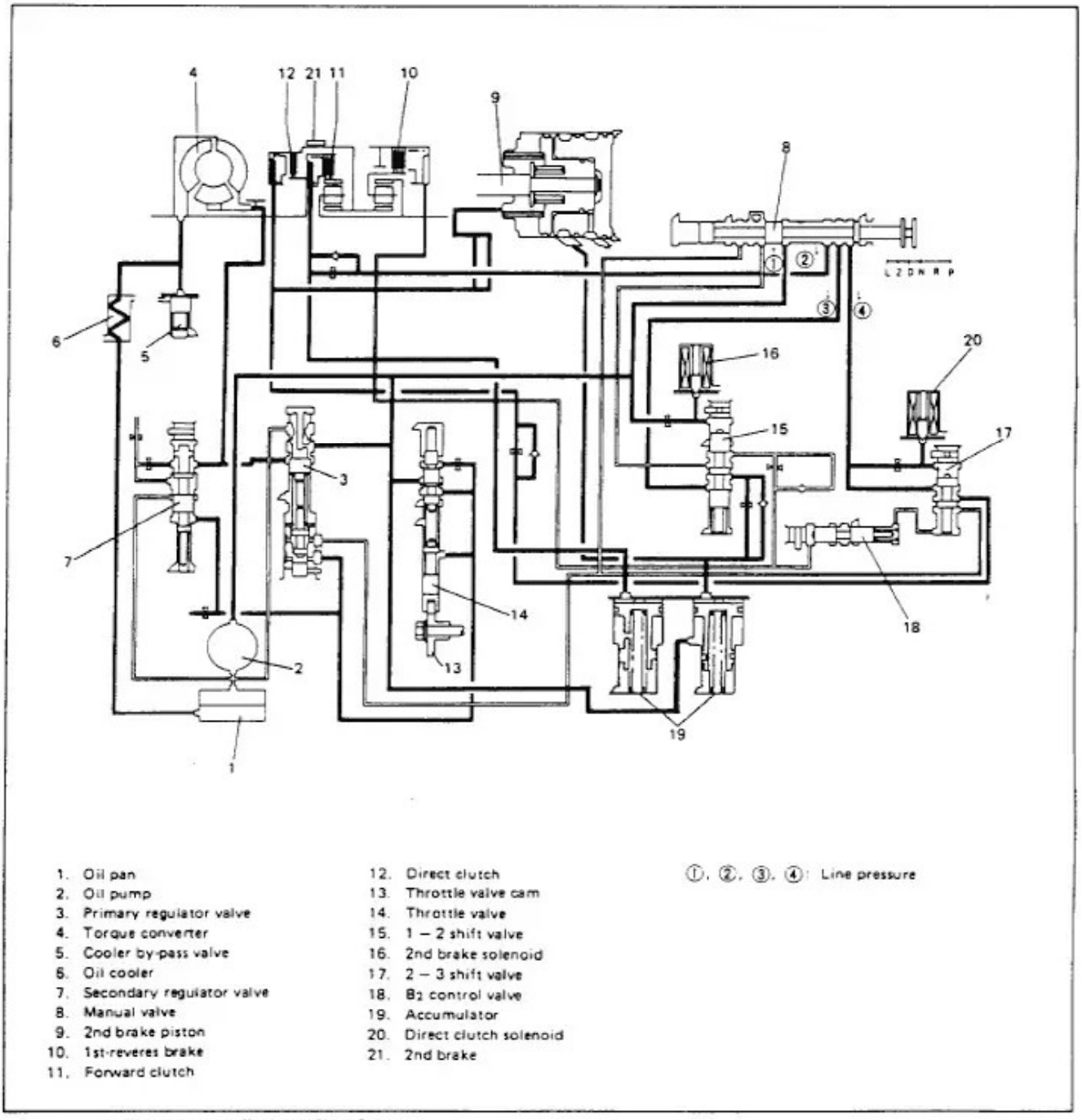
①, ②, ③: Line pressure

Oil Circuit in "D" or "2" Range (2nd Gear)

Oil Circuit in "D" Range (3rd Gear)

As the car speed is further accelerated in the 2nd gear and reaches the 3rd gear shift point, the direct clutch solenoid turns OFF and closes the relief circuit. This causes the line pressure ④ to be applied to the 2 – 3 shift valve. Then the oil pressure is applied to the direct clutch to make it engaged. At the same time, the oil pressure acts, as a back pressure, on the 2nd brake piston. Thus the 2nd brake piston is pushed back, the 2nd brake is released and the 3rd gear is attained.

In this state, as the 2nd brake solenoid is OFF, the 1 – 2 shift valve is at work and opens the oil passage to the 2nd brake but the 2nd brake does not operate. It is because the oil pressure to the 2nd brake is balanced with the above mentioned back pressure and the return spring force pushes back the piston to prevent the 2nd brake from operating.



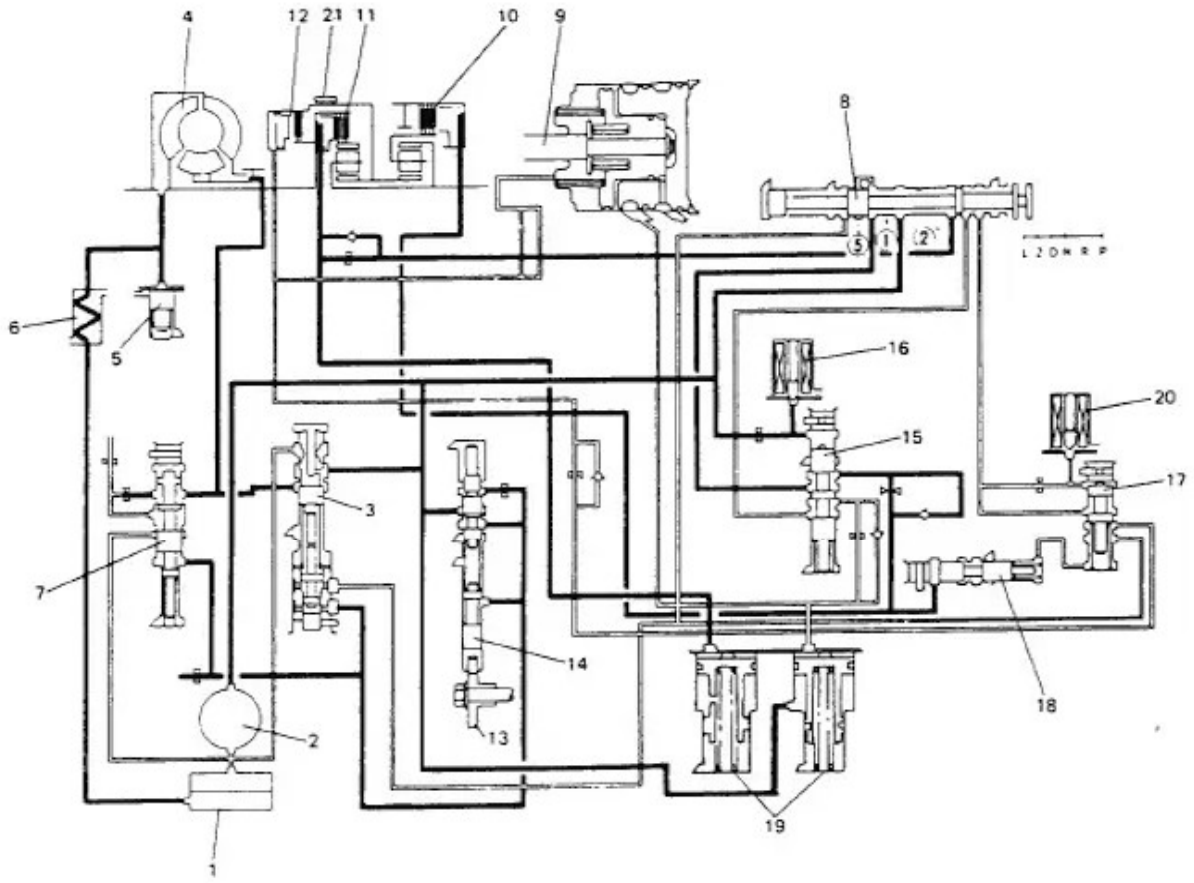
1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reveres brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B_2 control valve
19. Accumulator
20. Direct clutch solenoid
21. 2nd brake

①, ②, ③, ④: Line pressure

Oil Circuit in "D" Range (3rd Gear)

Oil Circuit in "L" Range

The line pressure ①, after passing through the manual valve, comes out as the line pressures ② and ⑤. The line pressure ② is applied to the forward clutch. In this state, as the 2nd brake solenoid is OFF because it is not electrically charged from the controller, the line pressure ① is applied to the 1 – 2 shift valve. Then the line pressure is applied to the 1st-reverse brake. Consequently the 1st gear is attained.



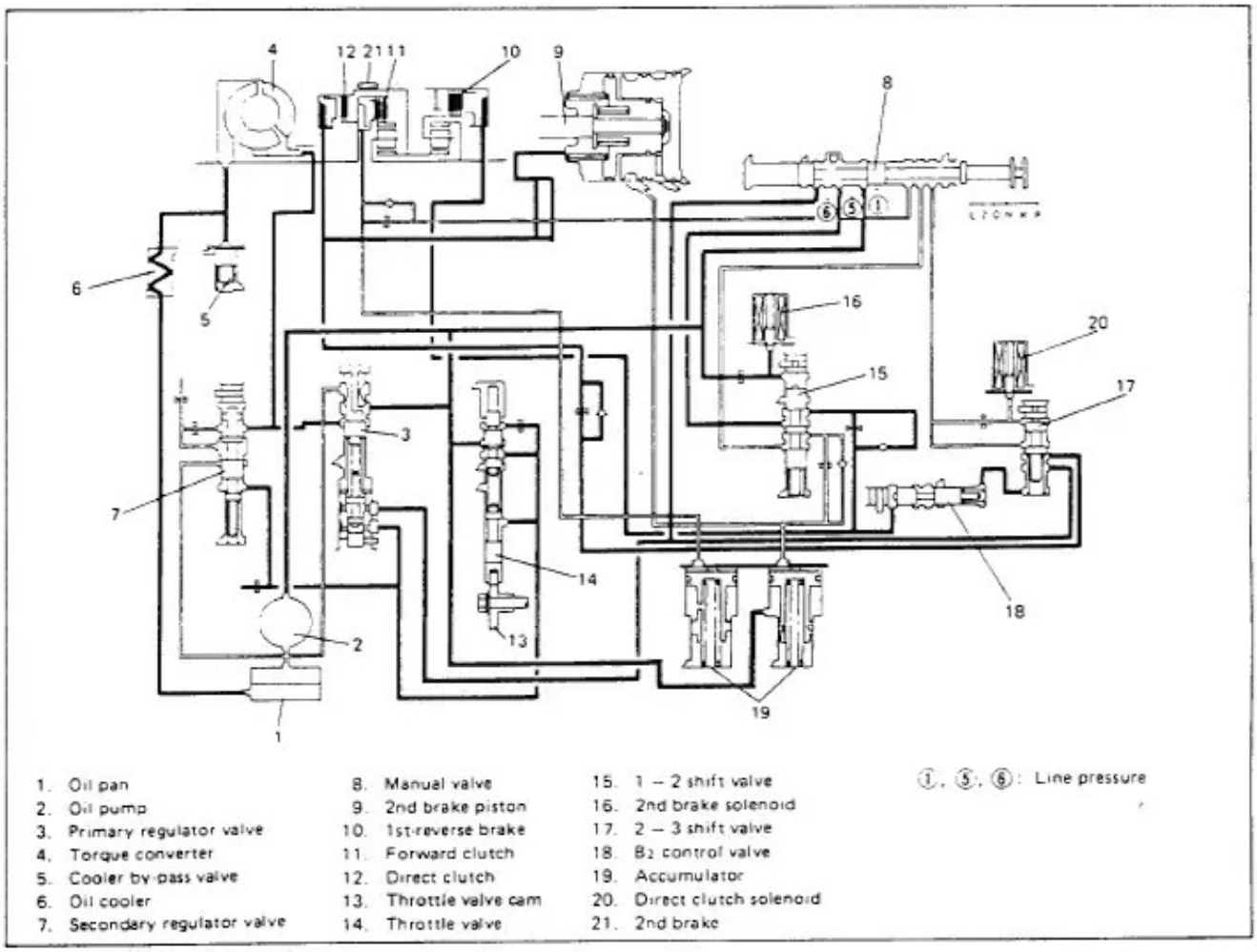
1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reverse brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B₂ control valve
19. Accumulator
20. Direct clutch solenoid
21. 2nd brake

①, ②, ⑤: Line pressure

Oil Circuit in "L" Range

Oil Circuit in "R" Range

The line pressure ①, after passing through the manual valve, comes out as the line pressures ⑤ and ⑥. In this state, as the 2nd brake solenoid is OFF, the line pressure ① is applied to the 1 – 2 shift valve and the line pressure ⑤ is applied to the 1st-reverse brake after passing through the B_2 control valve. On the other hand, the line pressure ⑥ is applied to the direct clutch via the 2 – 3 shift valve, thus resulting in the reverse gear. Also, a part of the line pressure ⑥ acts on the primary regulator valve to regulate the line pressure ①.



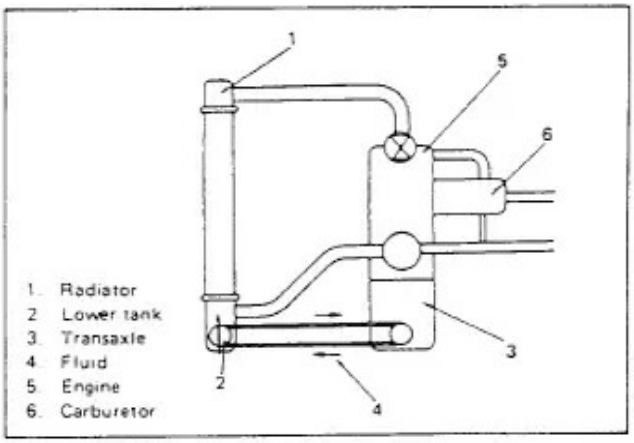
1. Oil pan
2. Oil pump
3. Primary regulator valve
4. Torque converter
5. Cooler by-pass valve
6. Oil cooler
7. Secondary regulator valve
8. Manual valve
9. 2nd brake piston
10. 1st-reverse brake
11. Forward clutch
12. Direct clutch
13. Throttle valve cam
14. Throttle valve
15. 1 – 2 shift valve
16. 2nd brake solenoid
17. 2 – 3 shift valve
18. B_2 control valve
19. Accumulator
20. Direct clutch solenoid
21. 2nd brake

①, ⑤, ⑥: Line pressure

Oil Circuit in "R" Range

Oil Cooling System

The oil cooler of dual pipe type is built in the lower tank of the engine cooling radiator and cools off the automatic transaxle fluid.



1. Radiator
2. Lower tank
3. Transaxle
4. Fluid
5. Engine
6. Carburetor

Oil Cooling System

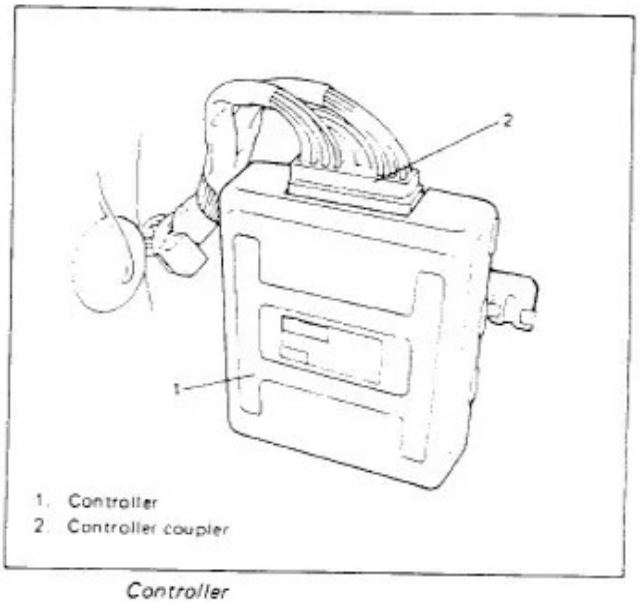
GEAR SHIFT CONTROL SYSTEM

Controller

The controller controls the 2nd brake solenoid and the direct clutch solenoid by sending electric signals to them so as to attain automatic gear shift between the 1st and 2nd gears, and the 2nd and 3rd gears.

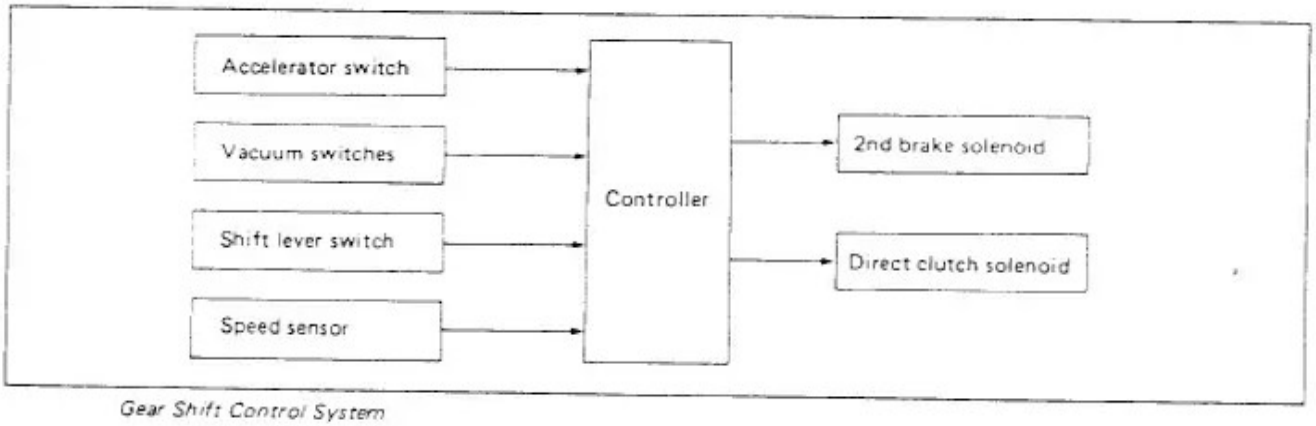
Equipped as controller sensed parameters are the accelerator switch, vacuum switches (No. 1, 2 & 3), shift lever switch and speed sensor. These switches and sensor sense the carburetor throttle valve opening, selector lever's position and car speed, and send signals to the controller. Then, the controller opens and closes the valves of the above solenoids according to these signals.

The Controller is located at the right corner inside the instrument main panel.



1. Controller
2. Controller coupler

Controller



Gear Shift Control System

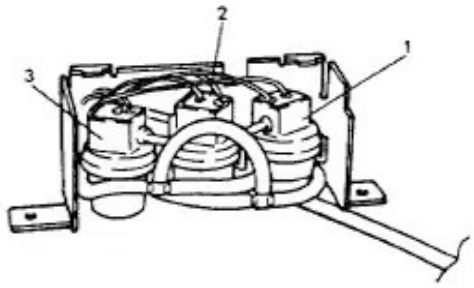
(Automatic shift speed)

km/h (mile/h)

Shift position / Throttle valve opening	"D" range				"2" range	
	1 → 2	2 → 3	3 → 2	2 → 1	1 → 2	2 → 1
Below 40%	13 – 17 (8 – 10)	28 – 32 (18 – 20)	8 – 12 (5 – 7)	8 – 12 (5 – 7)	13 – 17 (8 – 10)	8 – 12 (5 – 7)
40 ~ 60%	18 – 22 (11 – 13)	40 – 44 (25 – 27)	8 – 12 (5 – 7)	8 – 12 (5 – 7)	18 – 22 (11 – 13)	8 – 12 (5 – 7)
60 ~ 80%	28 – 32 (18 – 20)	51 – 59 (32 – 37)	28 – 32 (18 – 20)	8 – 12 (5 – 7)	28 – 32 (18 – 20)	8 – 12 (5 – 7)
80 ~ 90%	43 – 47 (27 – 29)	86 – 94 (53 – 58)	48 – 52 (30 – 32)	18 – 22 (11 – 13)	43 – 47 (27 – 29)	18 – 22 (11 – 13)
Above 90%	51 – 59 (32 – 37)	96 – 104 (60 – 65)	81 – 89 (50 – 55)	38 – 42 (24 – 26)	51 – 59 (32 – 37)	38 – 42 (24 – 26)

Vacuum Switch

The vacuum switch contact point is turned ON or OFF by the carburetor vacuum and signals the carburetor throttle valve opening (engine load) to the controller.
There are three vacuum switches and each of them has its own range for ON/OFF operation. By means of these vacuum switch signals and carburetor throttle valve opening signals, the controller senses the throttle valve opening and the engine load.



1. Vacuum switch No. 1
2. Vacuum switch No. 2
3. Vacuum switch No. 3

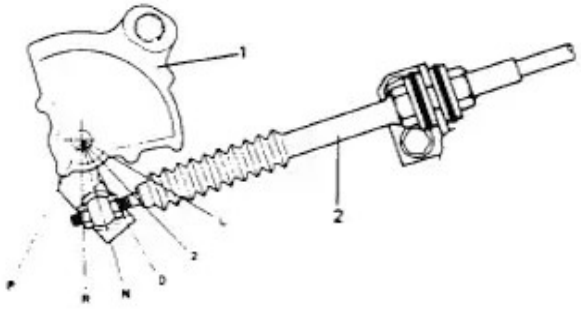
Vacuum Switch

Carburetor Throttle Valve Opening (%)	Carburetor Vacuum (mm Hg)	Vacuum Switch		
		No. 1	No. 2	No. 3
Below 40	More than 300	X	X	X
40 – 60	300 – 200	O	X	X
60 – 80	200 – 100	O	O	X
Above 80	Less than 100	O	O	O

O : Switch "ON" X : Switch "OFF"

Shift Lever Switch

Being linked with the selector lever, this switch changes selector lever positions into electric signals and send them to the controller. The contact points of this switch for "P" and "N" ranges are also connected with the starter motor circuit. So when the selector lever is shifted to the "P" or "N" position, the contact points for "P" or "N" range are connected and cause the starter motor to operate by turning the starter switch "ON". When the selector lever is in any other position than "P" and "N", the switch remains "OFF" and therefore the starter motor cannot be operated, that is, the engine cannot be started.
Also, as its contact point for "R" range is connected with the back up light circuit, only when the selector lever is shifted to "R" range, the contact point contacts to light the back up light.



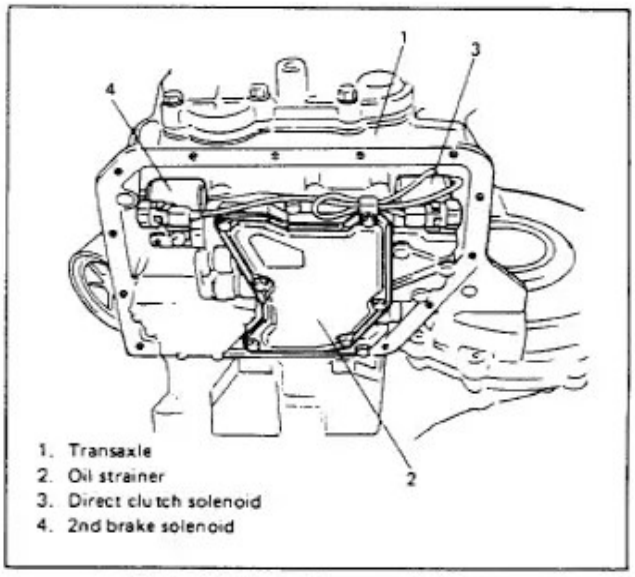
1. Shift lever switch
2. Select cable

Shift Lever Switch

Direct Clutch and 2nd Brake Solenoids

These solenoids are mounted on the valve body. They are turned ON and OFF by the signals from the controller and actuate each shift valve (1 – 2 and 2 – 3 valves) so as to control transmission gear shift.

2nd brake solenoid operates 1 – 2 shift valve, and direct clutch solenoid does 2 – 3 shift valve.



Direct Clutch and 2nd Brake Solenoid

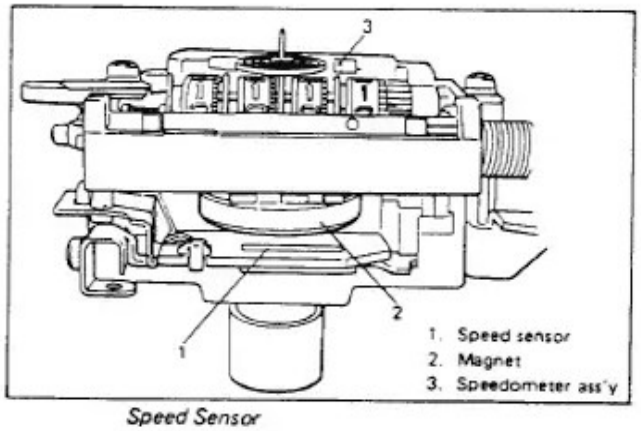
Operation of Direct Clutch and 2nd Brake Solenoids

Range	D			2		L		R	P
Gear	1st	2nd	3rd	1st	2nd	1st	(2nd)	–	–
Direct clutch solenoid	O	O	X	X	O	X	X	X	X
2nd brake solenoid	O	X	X	O	X	X	O	X	X

O : Operated (Solenoid Valve is Open) X : Unoperated (Solenoid Valve is Close)

Speed Sensor

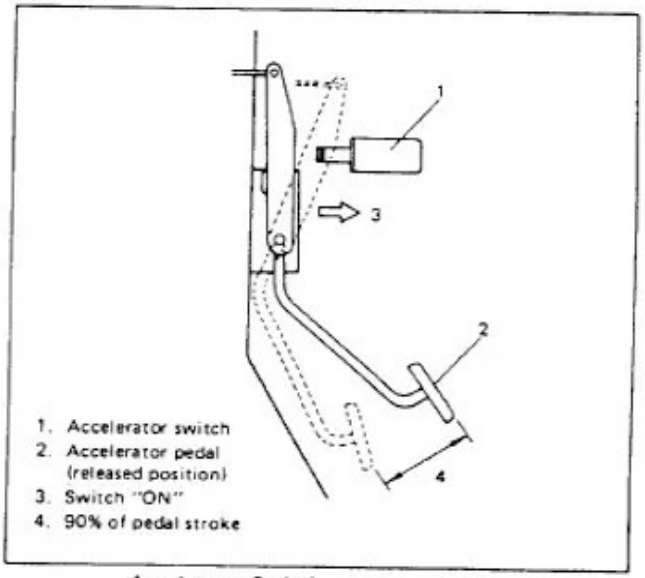
The speed sensor consisting of the lead switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the lead switch to turn ON and OFF. Such ON/OFF frequency increases or decreases in proportion with the car speed and is sent to the controller as pulse signals.



Speed Sensor

Accelerator Switch

The accelerator switch is mounted on the accelerator pedal bracket. When the accelerator pedal is depressed more than 90% of its stroke, the switch turns ON and signals carburetor throttle valve opening to the controller.



Accelerator Switch

MAINTENANCE

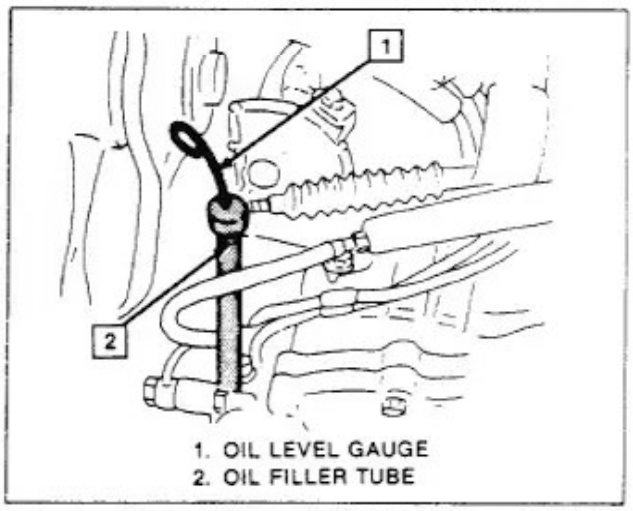
TRANSAXLE FLUID LEVEL

Checking Level (Transaxle at Normal Operating Temperature)

Be sure to check fluid level at every engine oil change. As the automatic transaxle is designed to operate at normal operating temperature (70°C – 80°C, 158°F – 176°F) of fluid, perform fluid level check when fluid temperature is within the above temperature range. Driving at 60 km/h (37 mile/h) in "D" range for about 15 minutes will raise fluid temperature to normal operating temperature (70°C – 80°C, 158°F – 176°F).

Fluid level check procedure is as follows.

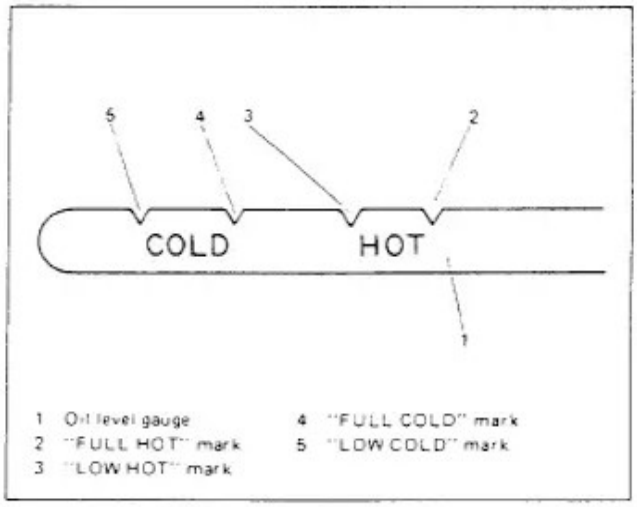
1. Place car on level surface.
2. Apply parking brake and block car wheels.
3. With selector lever in "P" position, start engine. DO NOT RACE ENGINE.
4. Run engine at idle speed and move selector lever through each range and put it in "P" position again.
5. With engine running at idle, remove oil level gauge from oil filler tube and wipe off oil level gauge with clean cloth.



Oil Level Gauge and Oil Filler Tube

6. Reinsert oil level gauge into oil filler tube, thoroughly.
7. Take up the gauge and check oil level on it. The level should be between "FULL HOT" and "LOW HOT" marks. If level is below "LOW HOT" mark, add fluid to bring the level to "FULL HOT" mark. Bringing fluid level from "LOW HOT" mark to "FULL HOT" mark requires 0.3 liters (0.63/0.53 US/Imp pt) of fluid. Use DEXRON –II or equivalent automatic transmission fluid.

NOTICE:
Do not overfill. Overfilling can cause foaming and loss of fluid through the vent. Then slippage and transaxle failure can result.



Fluid level

Checking Level (Transaxle at Room Temperature of About 25°C (77°F))

If transaxle was overhauled or fluid was drained for oil pan (and or valve body) service, refill fluid after assembling and check its level according to the following procedures.

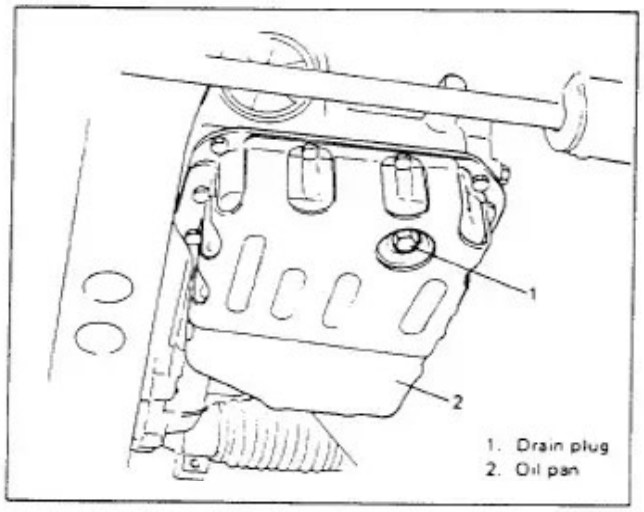
1. Place car on level surface.
2. Apply parking brake and block car wheels.
3. With selector lever in "P" position, start engine and run it at idle for 5 minutes. DO NOT RACE ENGINE.
4. Move selector lever through each range and put the lever in "P" position again.
5. With engine running at idle, check fluid level on oil level gauge. Fluid level should be between "FULL COLD" and "LOW COLD" marks on the oil level gauge.
6. If level is below "LOW COLD" mark, add fluid to bring the level between "LOW COLD" and "FULL COLD" marks. Use DEXRON–II or equivalent automatic transmission fluid. DO NOT OVERFILL.
7. The above COLD level check is strictly temporary. Therefore, as a final check, check fluid level for proper level through HOT level check at normal operating temperature (70°C – 80°C, 158°F – 176°F) as described previously.

CHANGING FLUID

Fluid Change Procedure

1. Raise car.
2. With transaxle cool, remove drain plug and drain fluid.
3. Install drain plug gasket and drain plug to oil pan, and tighten drain plug to the specification.

Tightening torque for drain plug	18 – 23 N-m 1.8 – 2.3 kg-m 13.5 – 16.5 lb-ft



Drain Plug

4. Remove oil level gauge from oil filler tube, and add 1.5 liters (3.16/2.64 US/Imp. pt) of new fluid from oil filler tube. Use DEXRON–II or equivalent automatic transmission fluid.

NOTICE:

- **When refilling transaxle with fluid after it is overhauled, pour about 3.5 liters (about 3.7/3.1 US/Imp. qt), assuming that torque converter is reused.**
- **When filling dry torque converter and transaxle ass'y with fluid, that is, after both of them were replaced, pour about 4.5 liters (about 4.7/3.9 US/Imp. qt).**

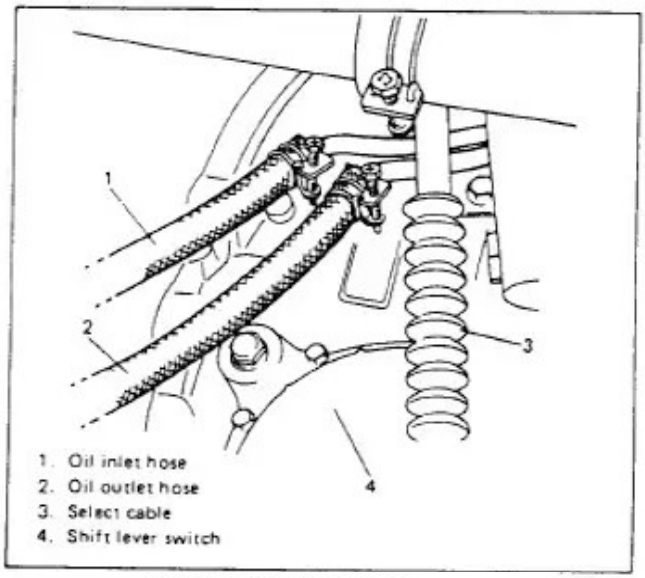
5. Check fluid level with transaxle at room temperature and at normal operating temperature as previously outlined.

Checking Transaxle Fluid Leakage

Check the transaxle (including oil hoses) for fluid leakage, each time when vehicle is on hoist.

Check the oil hoses (inlet and outlet) for loose connection, deterioration or damage.

If any defective, replace it.



Oil Inlet and Outlet Hoses

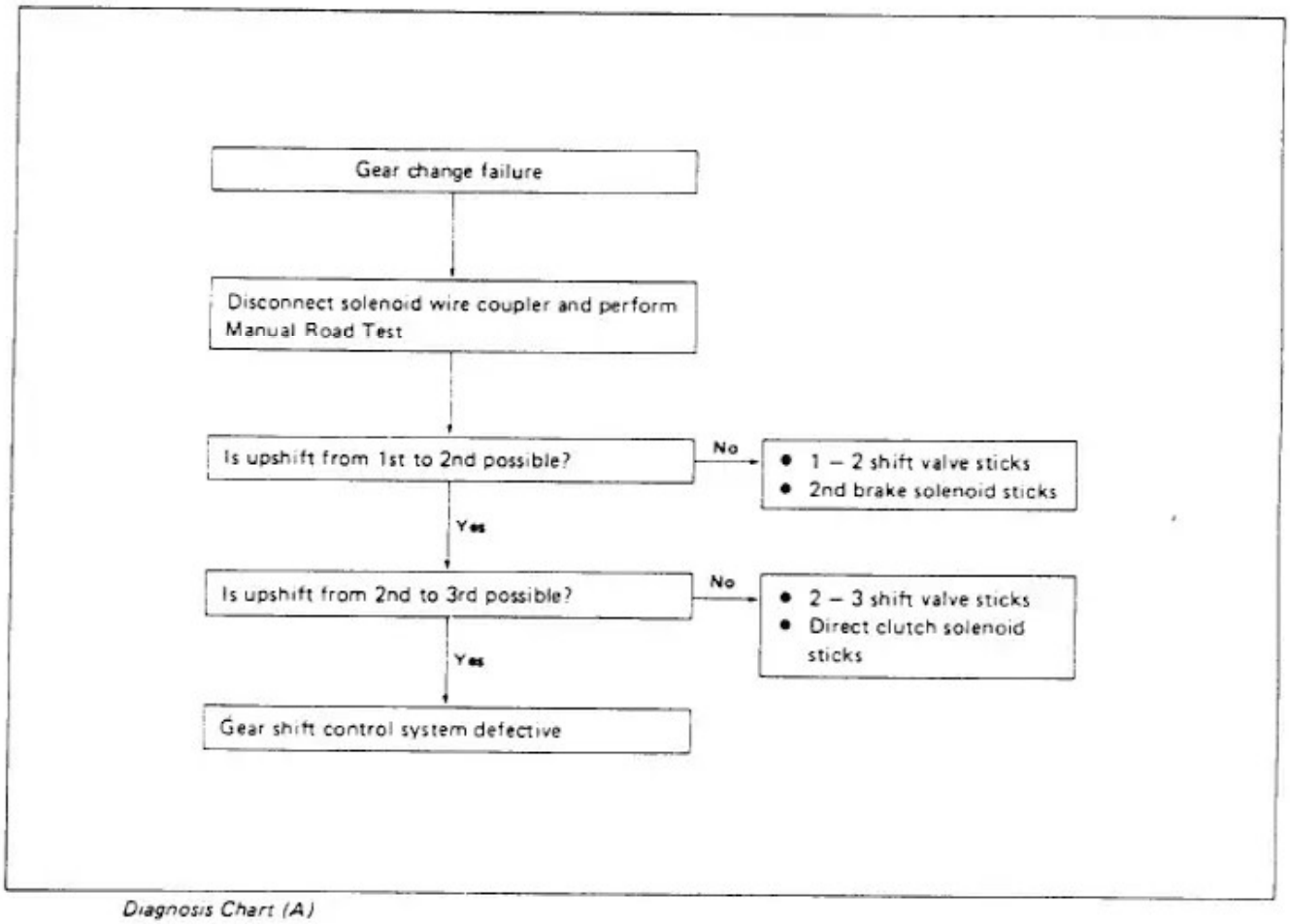
DIAGNOSIS

AUTOMATIC TRANSAXLE UNIT

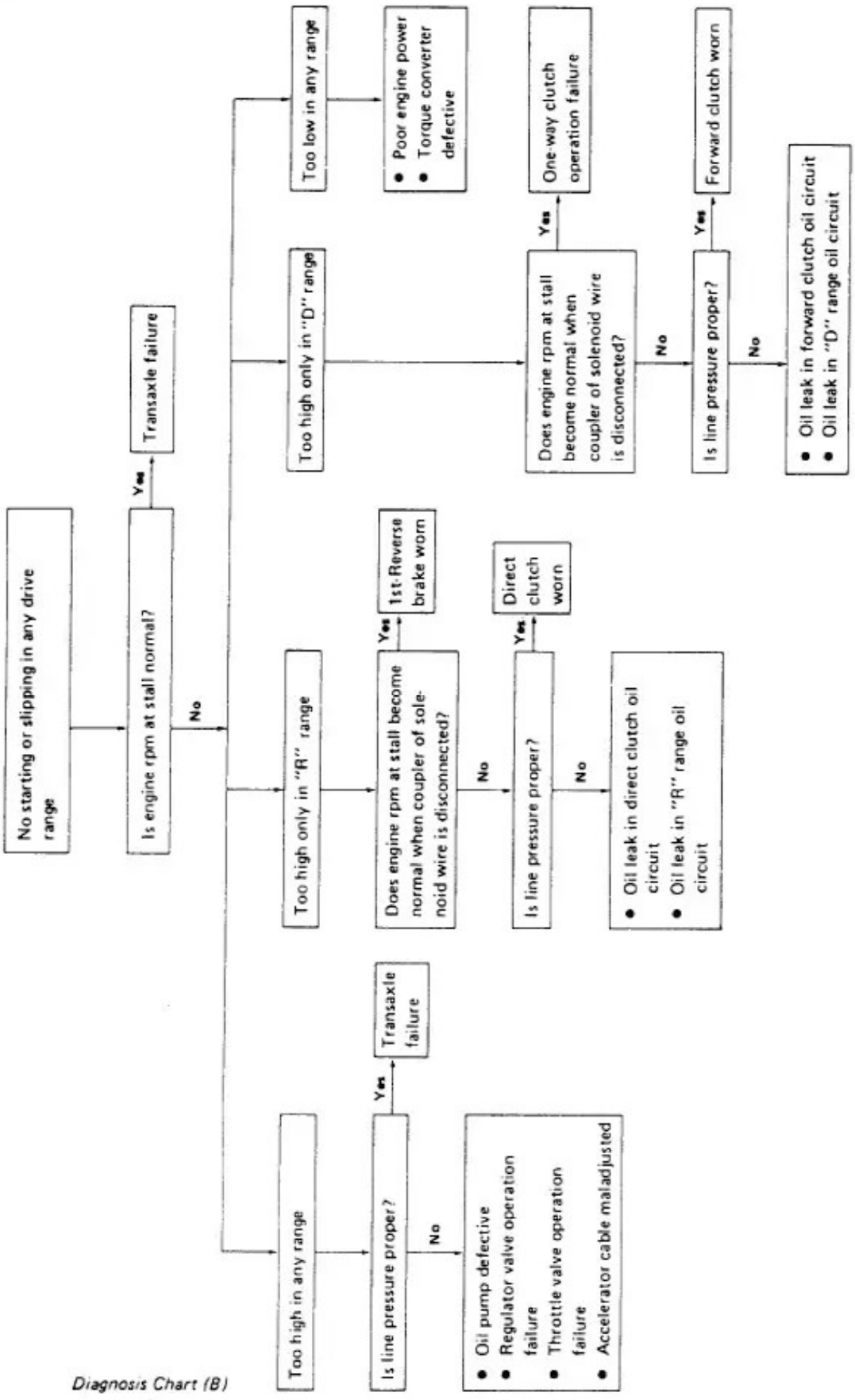
Systematic trouble shooting

Before performing systematic trouble-shooting described in this section, make sure to check each of the following.

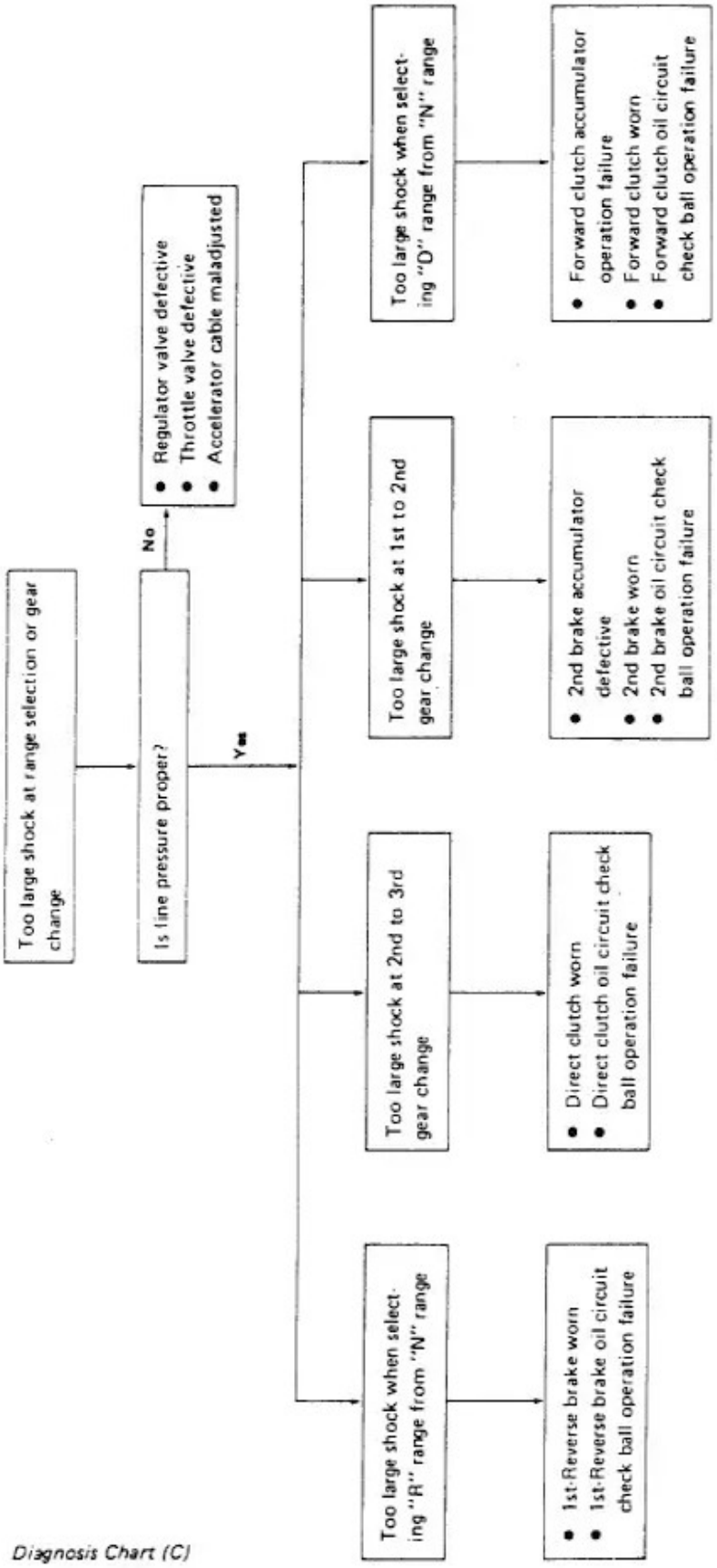
1. Engine coolant temperature is at normal operating temperature.
2. Engine idle speed is 850 rpm.
3. Transaxle fluid level is between "FULL HOT" and "LOW HOT" on oil level gauge at normal operating temperature of transaxle fluid.
4. Accelerator cable, oil pressure control cable and select cable are adjusted properly.
5. Electric circuit of gear shift control system is free from break, coupler disconnection and poor contact.
6. Vacuum hose of vacuum switch is securely connected.



Diagnosis Chart (A)



Diagnosis Chart (B)



Diagnosis Chart (C)

Line pressure test

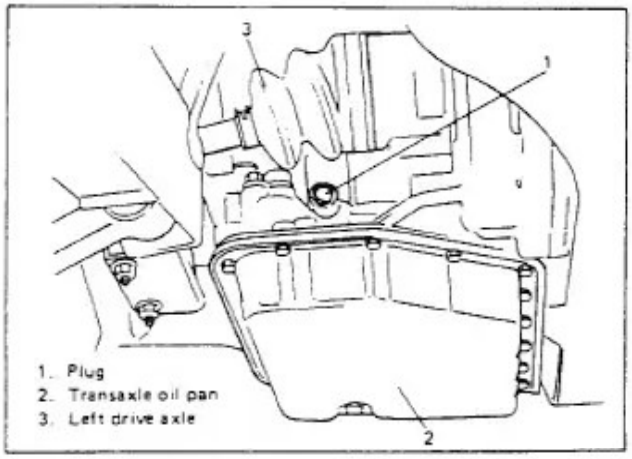
This test is to check oil pressure system for operation by measuring oil pressure in the oil pressure line. Make sure to perform the test only when transaxle fluid is at normal operating temperature.

Also, check for the following before the test.

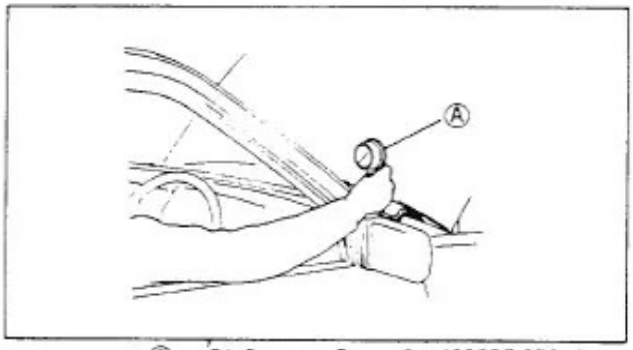
- Transaxle fluid level is between "FULL HOT" and "LOW HOT" marks on oil level gauge (at normal operating temperature of fluid).
- Transaxle is free of oil leakage.

Test procedure is as follows.

1. With engine at stop, remove plug as shown in figure and connect oil pressure gauge to the vacated threaded hole.



Plug



Ⓐ : *Oil Pressure Gauge Set (09925-37810)*

2. Install tachometer.
3. Apply parking brake and block car wheels.
4. With selector lever shifted to "P" position, start engine.
5. Depress brake pedal fully.
6. Shift selector lever to "D" range and check oil pressure with engine running at idling speed and at stall speed respectively.
7. Repeat the same check as in step 6 with selector lever shifted to "R" range.

NOTICE:

Don't run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.

8. If line pressure measured is within respective specification in the following table, oil pressure system is in good condition.

Engine speed	Line pressure	
	"D" range	"R" range
Idling speed (850 rpm)	2 – 4 kg/cm² 28.5 – 56.8 psi 200 – 400 kPa	5.5 – 8 kg/cm² 78.2 – 113.7 psi 550 – 800 kPa
Stall speed (2,100 – 2,300 r/min)	5 – 7 kg/cm² 71.1 – 99.5 psi 500 – 700 kPa	10.5 – 14 kg/cm² 149.3 – 199.1 psi 1050 – 1400 kPa

9. Possible causes for out-of-specification line pressure are as follows. Check each part which is suspected to be the cause.
10. Reinstall plug and tighten it to 0.6 – 0.9 kg-cm (6 – 9 N·m, 4.5 – 6.5 lb-ft).

Line pressure measured	Possible cause
Higher than specification in "D" & "R" ranges	• Regulator valve defective • Throttle valve defective • Accelerator cable and oil pressure control cable maladjusted
Lower than specification in "D" & "R" ranges	• Oil pump defective • Regulator valve defective • Throttle valve defective • Accelerator cable and oil pressure control cable maladjusted
Lower than specification only in "D" range	• Forward clutch oil pressure system oil leakage • "D" range oil pressure system oil leakage
Lower than specification only in "R" range	• Direct clutch oil pressure system oil leakage • 1st – reverse brake oil pressure system oil leakage • "R" range oil pressure system oil leakage

Stall test

This test is to check the overall performance of the automatic transaxle and engine by measuring stall speed at "D" and "R" ranges.

NOTICE:

1. **Be sure to perform the test only when transaxle fluid is at normal operating temperature.**
2. **Don't run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.**
3. **Stall speed means maximum engine rpm at "D" or "R" range with driving wheels held stationary.**

Test procedure

1. Install tachometer.
2. Apply parking brake and block car wheels.
3. Start engine with selector lever shifted to "P" range.
4. Depress brake pedal.
5. Shift selector lever to "D" range and depress accelerator pedal fully while watching tachometer. Read quickly the engine rpm when it has become constant (stall speed). Release accelerator pedal immediately after stall speed is checked.
6. In the same way, check stall speed at "R" range.
7. Stall speed should be within the following specification.

Stall speed	2,100 – 2,300 r/min (rpm)

8. Possible causes for out-of-specification stall speed are as follows. Check each part which is suspected to be the cause.

Stall speed measured	Possible causes
Lower than specification	• Engine output insufficient • Torque converter defective
Higher than specification in "D" range	• Forward clutch slippage • One-way clutch defective
Higher than specification in "R" range	• Direct clutch slippage • 1st – reverse brake slippage

Road test

This test is to check if upshift and downshift take place at specified speeds while actually driving car.

NOTICE:

1. **Carry out the test in very little traffic area to prevent an accident.**
2. **The test requires 2 persons, a driver and a tester.**
3. **Use a level road for the test.**

Test procedure

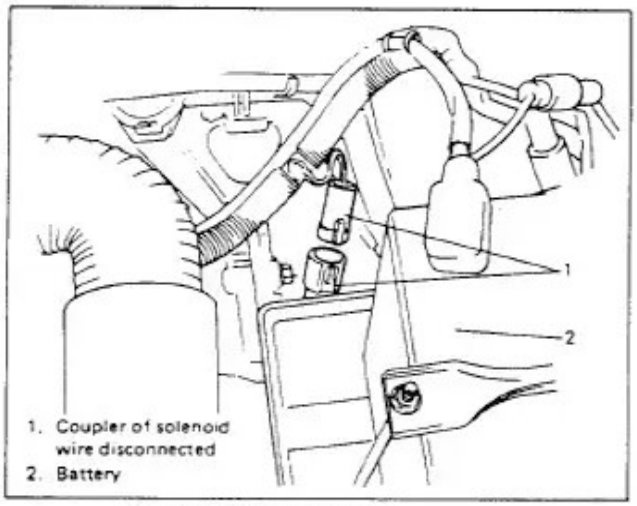
1. Warm up engine.
2. Disconnect vacuum switch coupler. Vacuum switch is installed in engine room.
3. With engine running at idle, shift selector lever to "D" range.
4. Accelerate car speed by depressing accelerator pedal half a stroke.
5. Check if upshift takes place from 1st to 2nd at about 15 km/h (10 mile/h) and from 2nd to 3rd at about 30 km/h (19 mile/h).
6. Stop car and shift selector lever to "P" range.
7. Connect vacuum switch coupler.
8. With selector lever shifted to "D" range, start car and accelerate by depressing accelerator pedal fully.
   And then check if upshift takes place from 1st to 2nd at 55 km/h (34 mile/h) and from 2nd to 3rd at 100 km/h (62 mile/h).
9. Stop car again.
10. Start car and keep it running at 25 km/h (16 mile/h) and then release accelerator pedal all the way back. 1 or 2 seconds later, depress accelerator pedal fully and check if downshift from 2nd to 1st takes place.
11. Keep car running at 75 km/h (47 mile/h) and in the same way as in step 10, check if downshift from 3rd to 2nd takes place.
12. If upshift or downshift fails to take place at each specified speed in the road test, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

Condition	Possible causes
No upshift from 1st to 2nd	• 1 – 2 shift valve defective • 2nd brake solenoid defective • Controller defective, or disconnection or poor connection in controller electric circuit
No upshift from 2nd to 3rd	• 2 – 3 shift valve defective • Direct clutch solenoid defective • Controller defective, or disconnection or poor connection in controller electric circuit
No downshift from 2nd to 1st or 3rd to 2nd	• Accelerator switch defective • Controller defective, or disconnection or poor connection in controller electric circuit

Manual road test

This test checks the gears being used in "L", "2" or "D" range when driven with unoperated gear shift control system.

1. With selector lever in "P" range, start engine and warm it up.
2. After warming up engine, disconnect the coupler of solenoid wire as shown in figure.



Coupler of Solenoid Wire

3. With selector lever in "L" range, start the car and accelerate to 30 km/h (18 mile/h). Check in this state that 1st gear is being used.
4. At 30 km/h (18 mile/h), Shift selector lever to "2" range and accelerate to 60 km/h (37 mile/h). Check in this state that 2nd gear is being used.
5. At 60 km/h (37 mile/h), shift selector lever to "D" range and check that 3rd gear is used when speed is higher than 60 km/h (37 mile/h).
6. After above checks, stop the car, then engine and connect solenoid wire coupler.

Engine brake test

NOTICE:

Before the test, make sure that there is no car behind so as to prevent rear-end collision.

Test procedure

1. While driving car in 3rd gear of "D" range, shift selector lever down to "2" range and check if engine brake operates then.
2. In the same way as in step 1, check engine brake for operation when selector lever is shifted down to "L" range.
3. If engine brake fails to operate in the above tests, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

Condition	Possible cause
Fails to operate when shifted down to "2" range	Second brake defective
Fails to operate when shifted down to "L" range	1st-reverse brake defective

"P" range test

1. Stop the car on a slope, shift selector lever to "P" range and at the same time apply parking brake.
2. After stopping engine, release parking brake lever gradually and check that car remains stationary.

GEAR SHIFT CONTROL SYSTEM

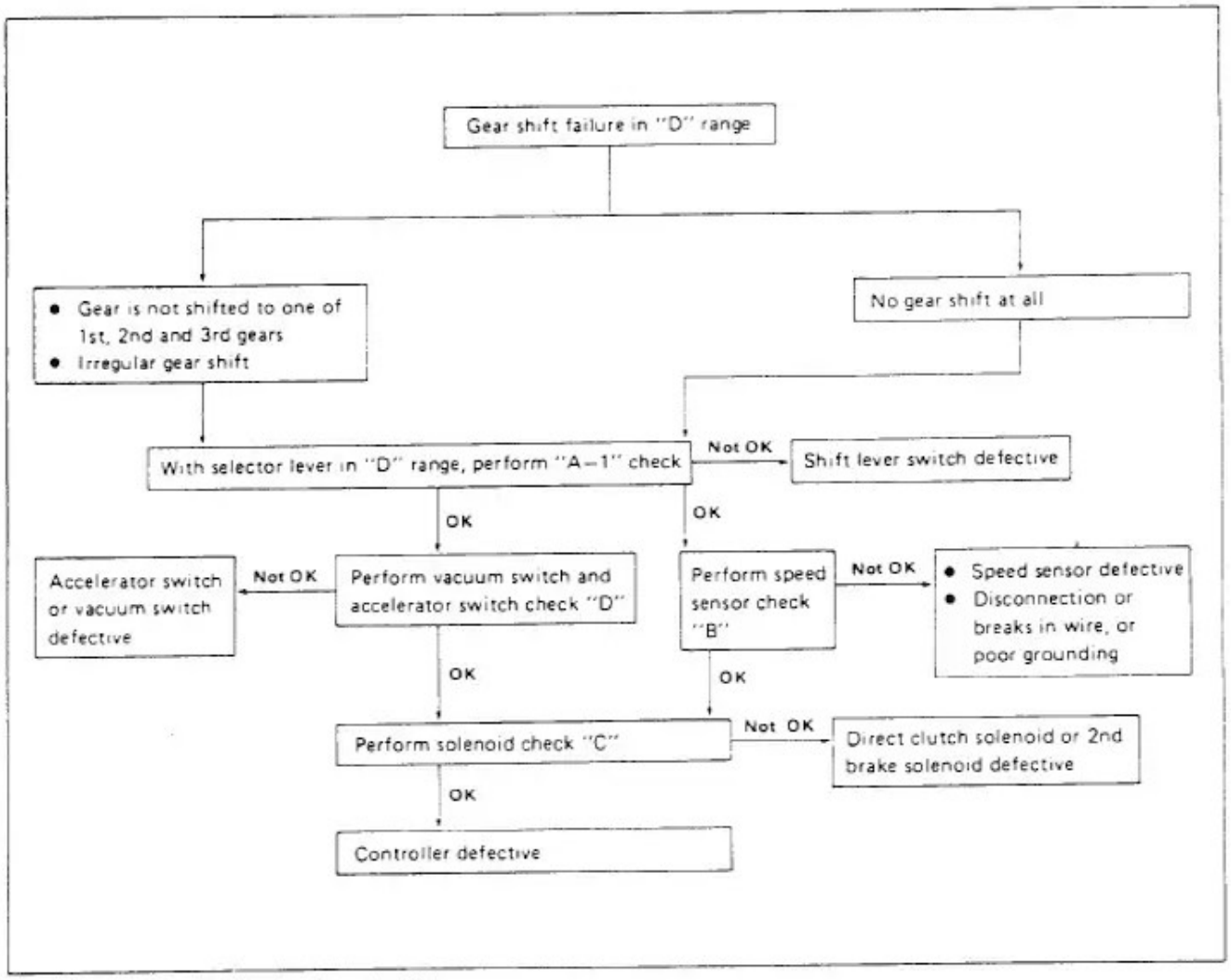
The method for gear shift control system trouble shooting described in the following pages involves the use of an accurate Multimeter (circuit tester).

Systematic trouble shooting:

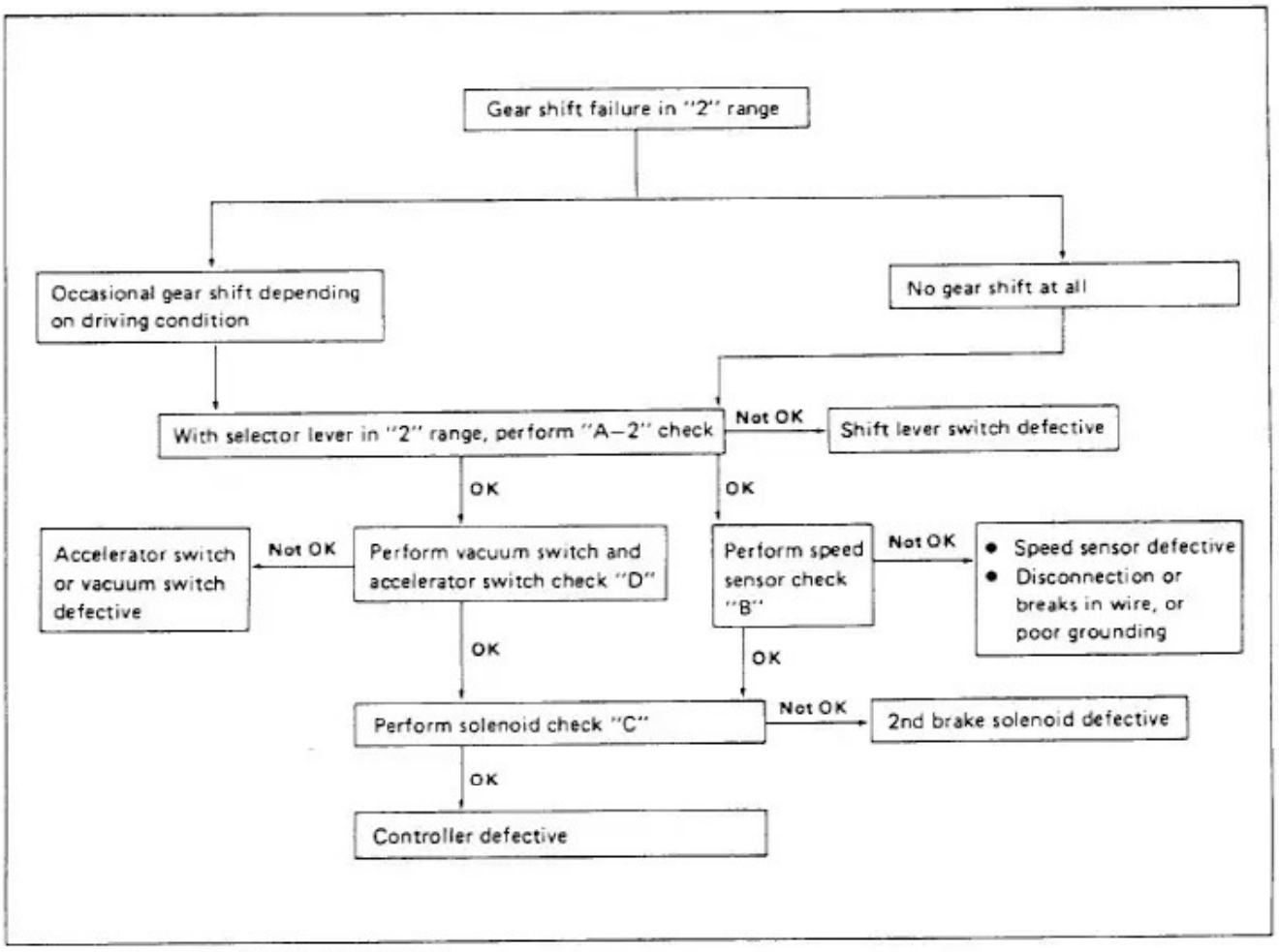
NOTICE:

Before performing systematic trouble shooting described in this section, make sure to check each of the following.

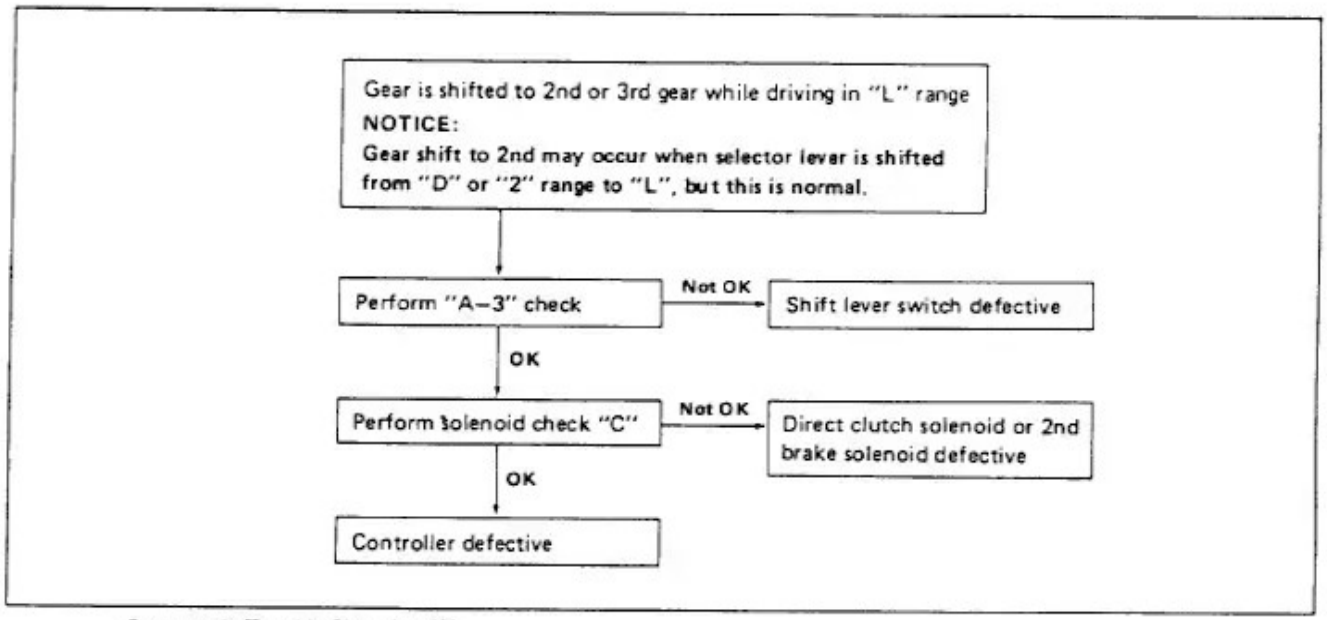
- **Electric circuit of gear shift control system is free from break, coupler disconnection and poor contact.**
- **Each hose of vacuum switches is securely connected.**



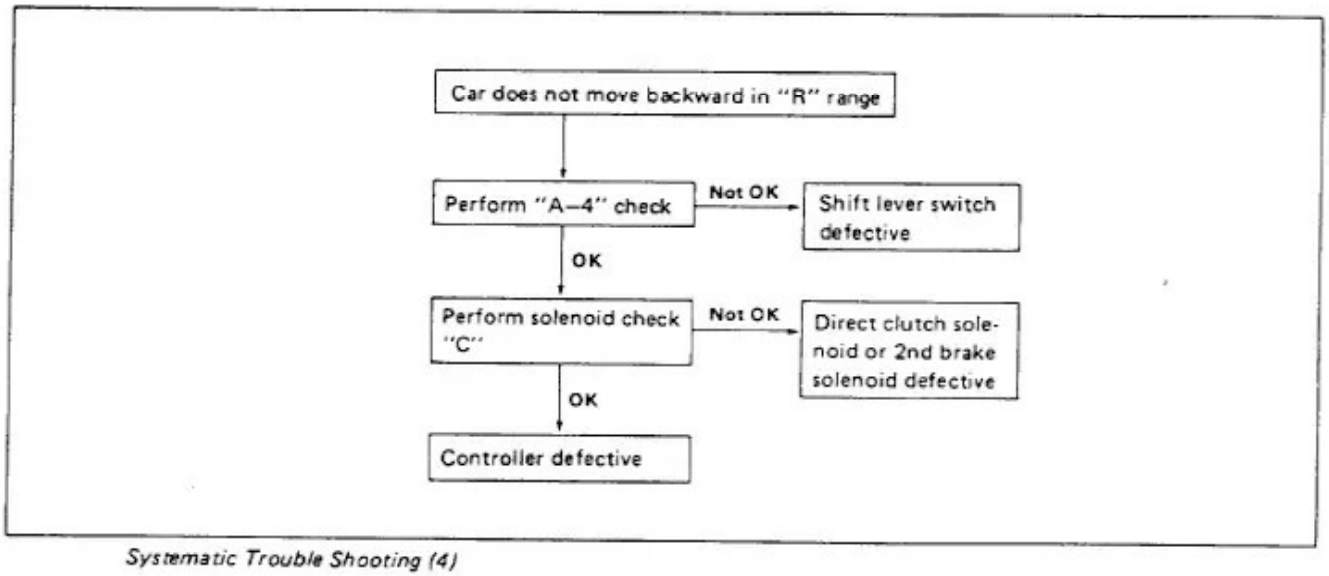
Systematic Trouble Shooting (1)



Systematic Trouble Shooting (2)



Systematic Trouble Shooting (3)



Systematic Trouble Shooting (4)

Range	Color of wires connected to shift lever switch coupler							
	Black/Red	Black/Yellow	Yellow	Red	Black	Green/Red	Green	Green/Blue
P	•	•						
R			•	•				
N	•	•						
D					•			•
2					•	•		
L					•		•	

Accelerator switch

Accelerator switch circuit check

With ignition switch turned "OFF", disconnect controller coupler. With accelerator pedal fully depressed, check for continuity between coupler terminals ⑥ and ⑫. Refer to page 7A1-45 for terminals ⑥ and ⑫.

Accelerator switch unit check

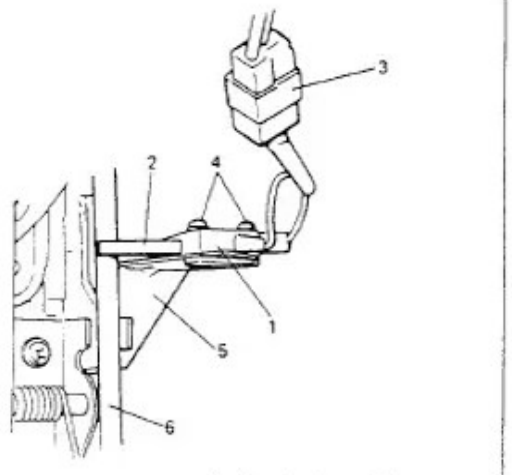
1. Disconnect coupler of accelerator switch mounted on accelerator pedal bracket.
2. Connect ohmmeter to accelerator switch coupler and check resistance with accelerator switch turned "ON" and "OFF" respectively by moving switch lever by hand.

Accelerator switch	Ohmmeter reading (resistance)
ON	Zero
OFF	Infinity

3. If found faulty in step 2 check, replace accelerator switch.
4. When replacing accelerator switch, install a new switch to pedal bracket according to the following procedure.

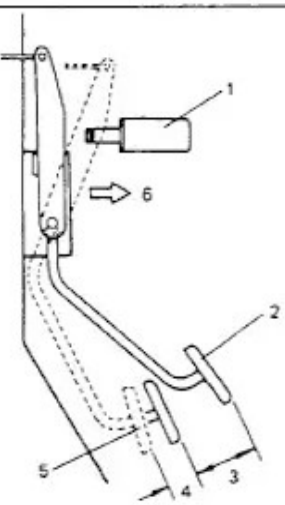
1) Install accelerator switch to pedal bracket. In this stage, tighten 2 switch mounting screws only temporarily, not securely.
2) Connect ohmmeter to switch coupler.
3) Depress accelerator pedal fully and check in this state that switch is "ON", that is, ohmmeter registers zero ohm.
4) Release accelerator pedal 10% of pedal stroke away from fully depressed position as shown. Holding pedal in this position, adjust switch by moving it so that switch turns from "ON" to "OFF", that is, ohmmeter pointer moves from zero to infinity. Tighten 2 switch mounting screws securely.

5. Connect switch coupler.



1. Accelerator switch
2. Switch lever
3. Coupler
4. Mounting screws
5. Accelerator pedal bracket
6. Accelerator pedal shaft

Accelerator Switch



1. Accelerator switch
2. Released accelerator pedal
3. 90% of pedal stroke
4. 10% of pedal stroke
5. Fully depressed pedal
6. Switch "ON"

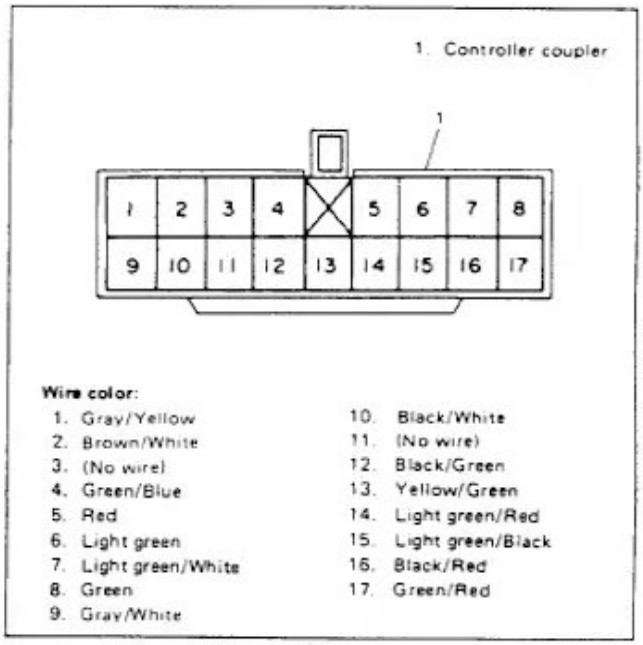
Accelerator switch Installation

Checking procedures for "A", "B", "C" and "D" checks.

NOTICE:
Do the following before carrying out A, B, C and D checks described hereunder.

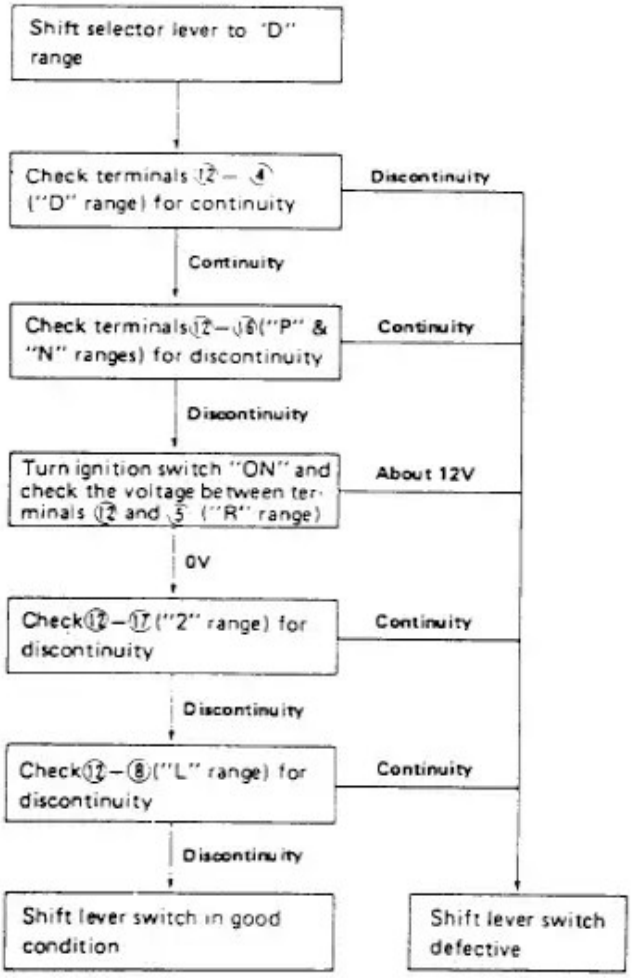
1. **Turn ignition switch "OFF".**
2. **After turning ignition switch "OFF", disconnect controller coupler.**

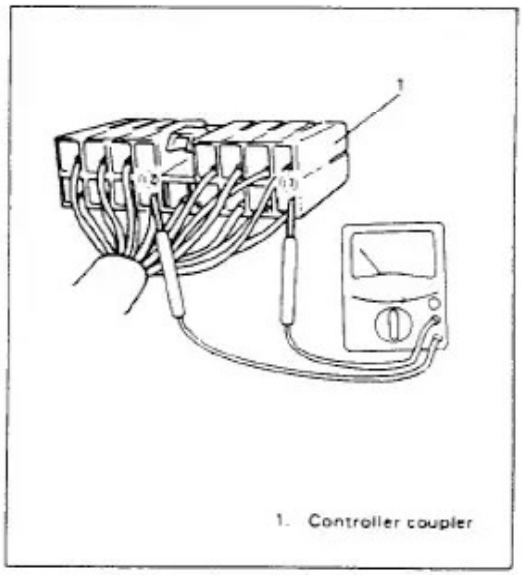
The figure (right) shows terminal numbers of the coupler as disconnected from controller viewed from wire harness side. For each check, bring ohmmeter prods in touch with terminals from wire harness side of coupler disconnected.



Coupler Terminal Numbers
(Viewed from Wire Harness Side)

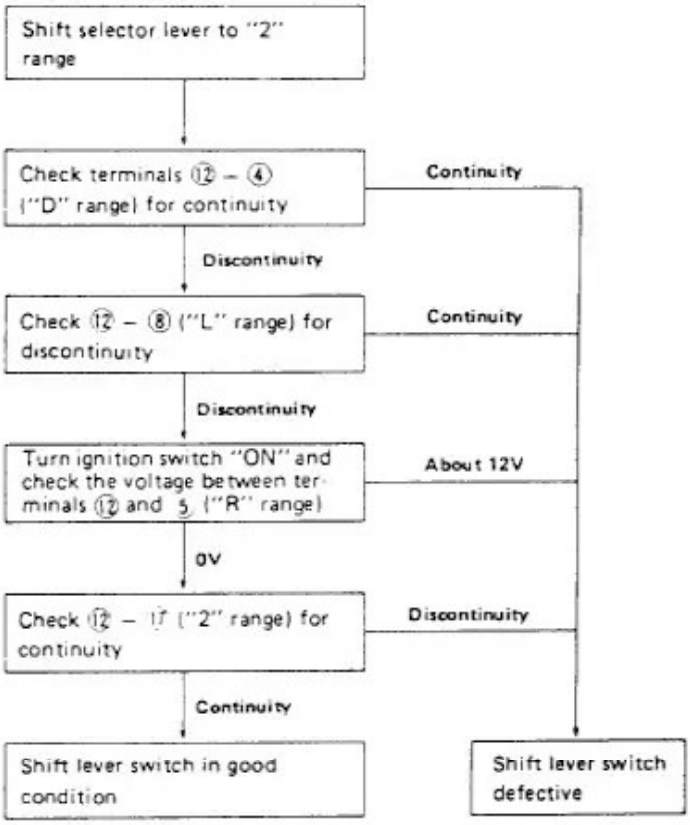
"A–1" check procedure

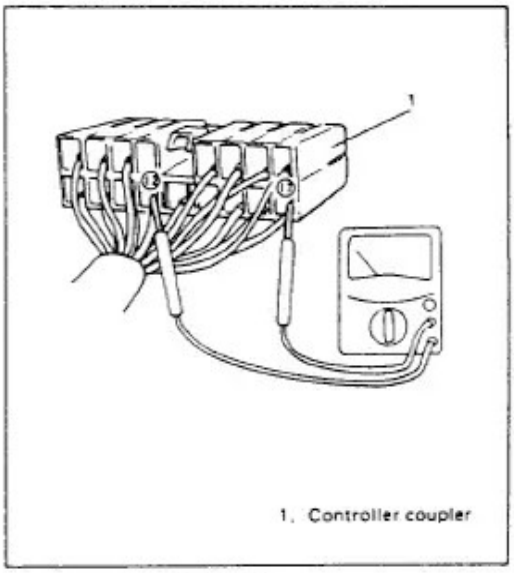




"A–1" Check

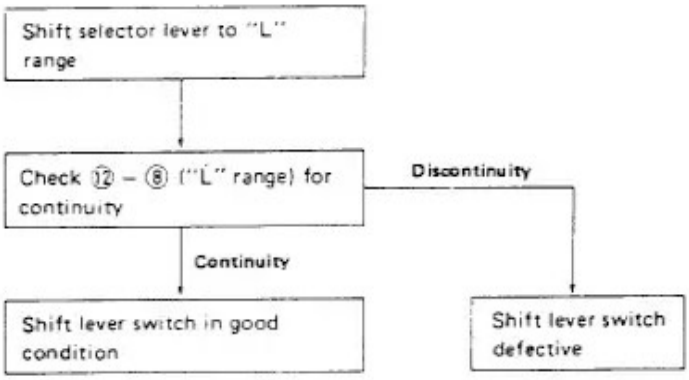
"A–2" check procedure

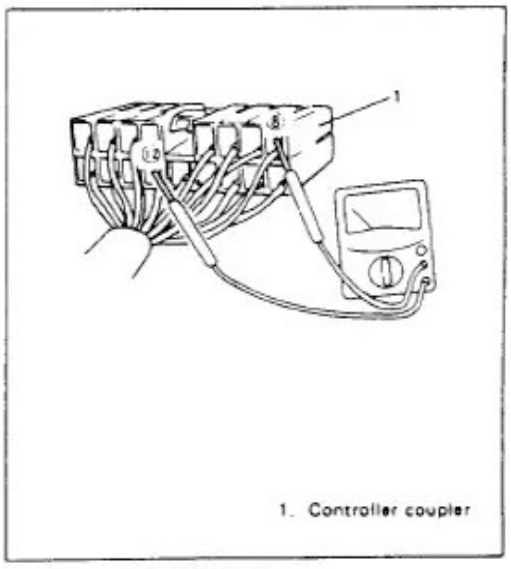




"A–2" Check

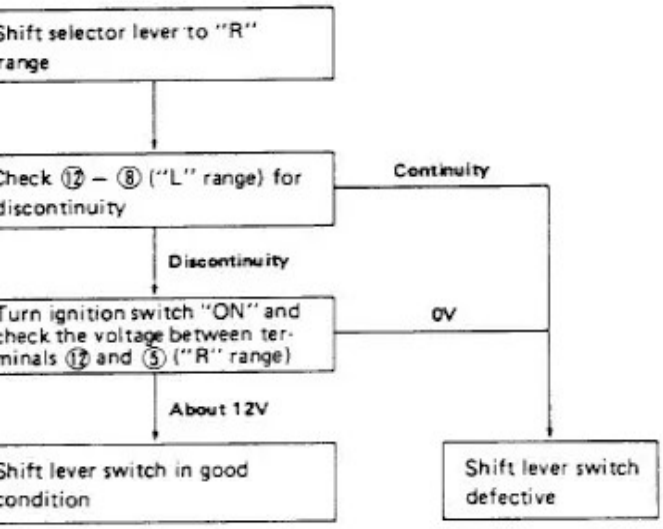
"A–3" check procedure

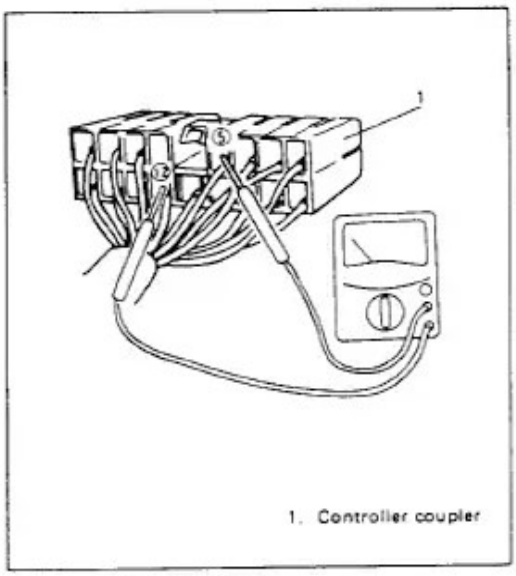




"A–3" Check

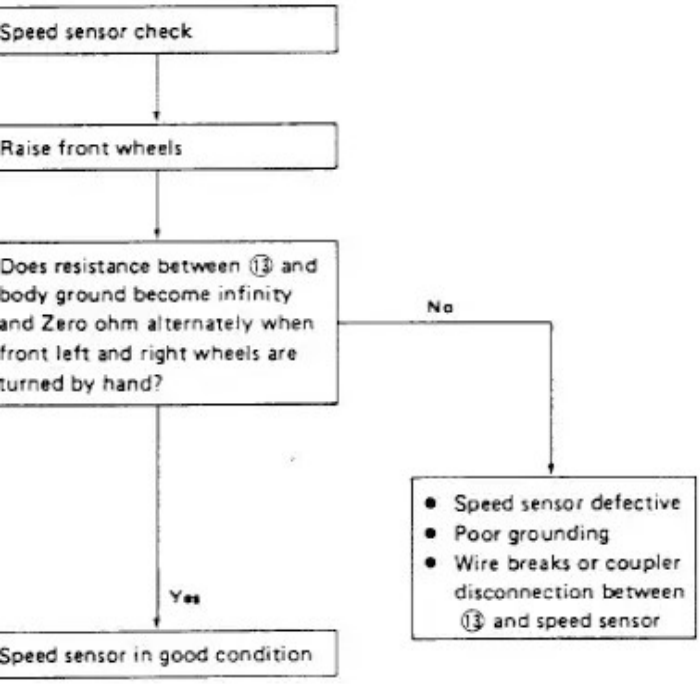
"A–4" check procedure

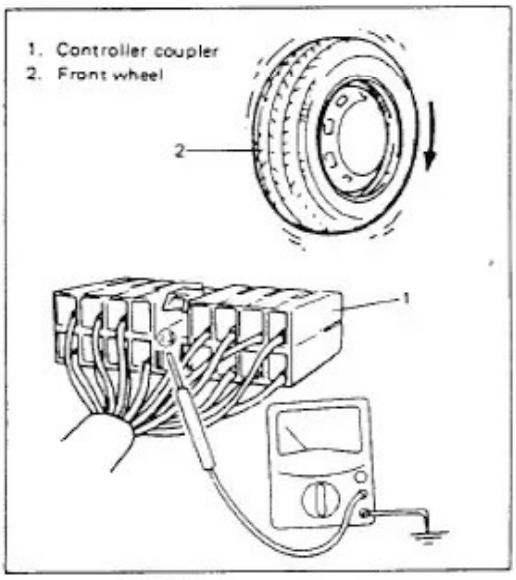




"A–4" Check

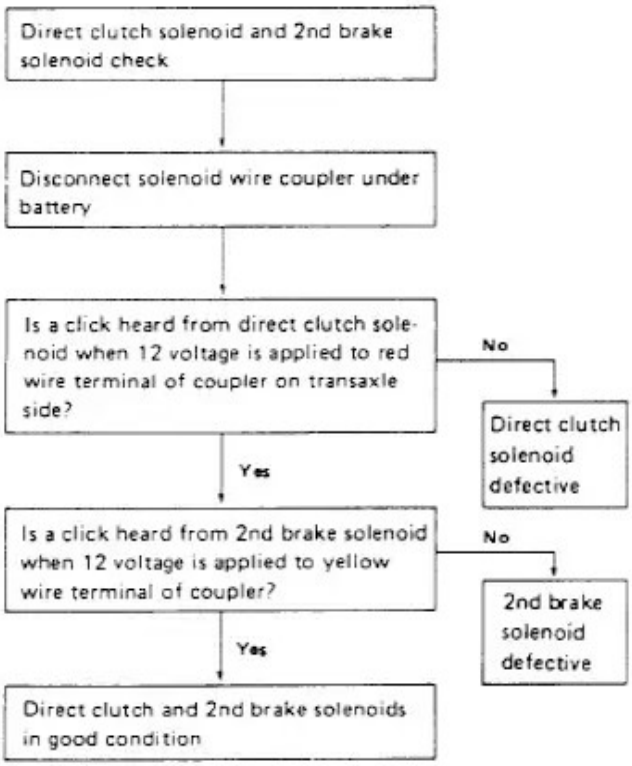
"B" check procedure

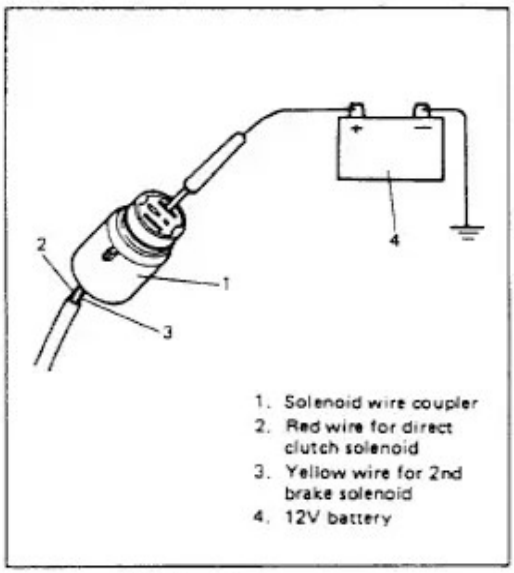




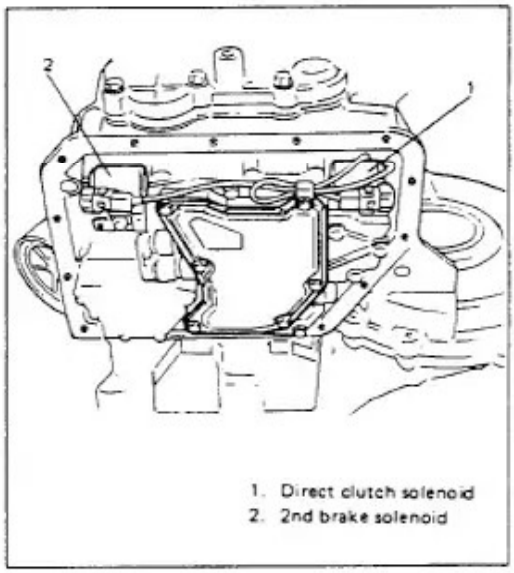
"B" Check

"C" check procedure





"C" Check

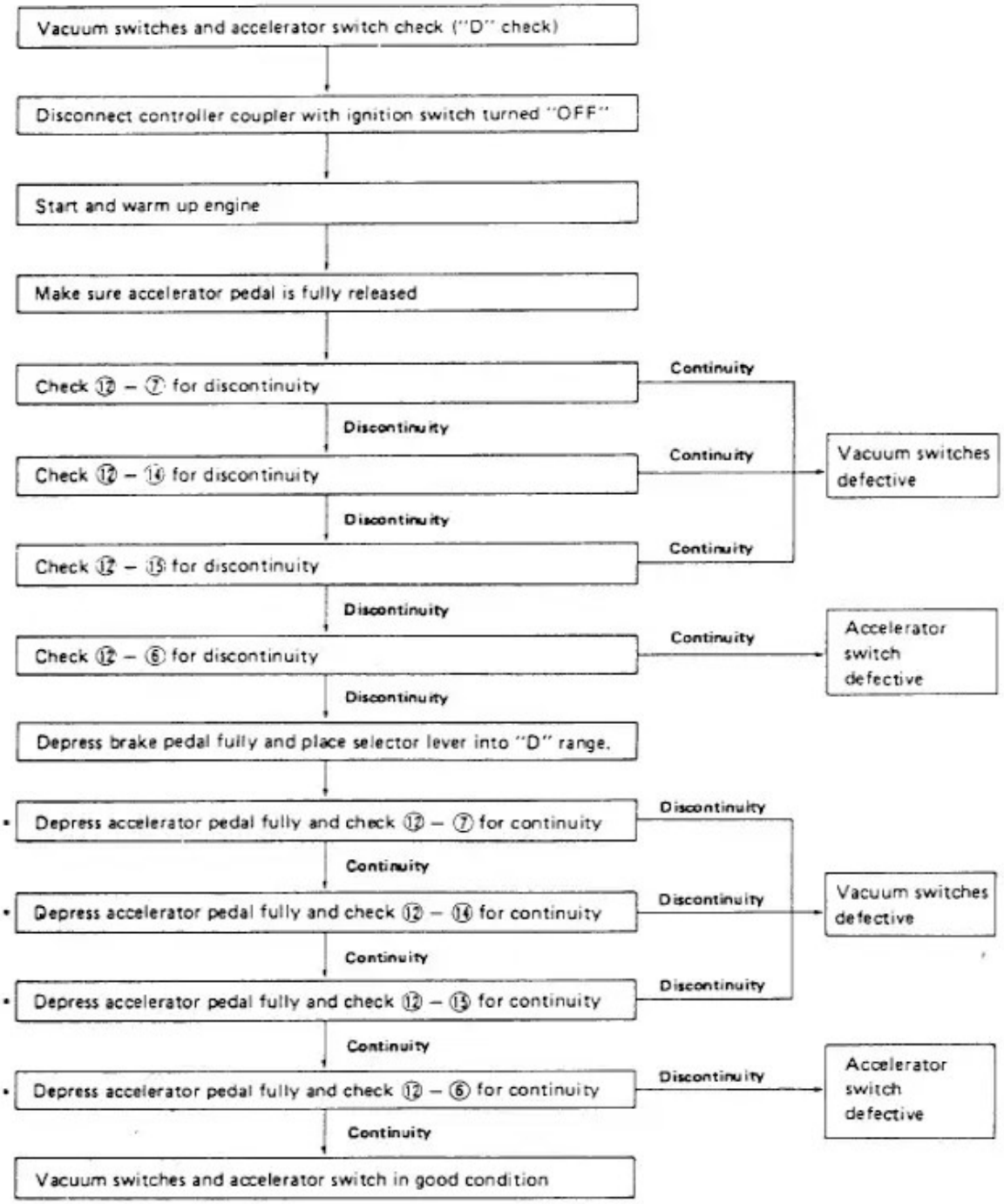


Direct Clutch and 2nd Brake Solenoid

"D" check procedure

NOTICE:

- Apply parking brake and block car wheels.
- Place selector lever into "P" range when accelerator pedal is released.
- Perform each check with engine running.
- Checks with asterisk mark (*) should be carried out within a short period of time and each continuity test in an instant, and accelerator pedal should be immediately released after each continuity test. Keeping accelerator pedal depressed fully for a long time (engine at high revolution speed) can cause transaxle fluid temperature to rise excessively high.



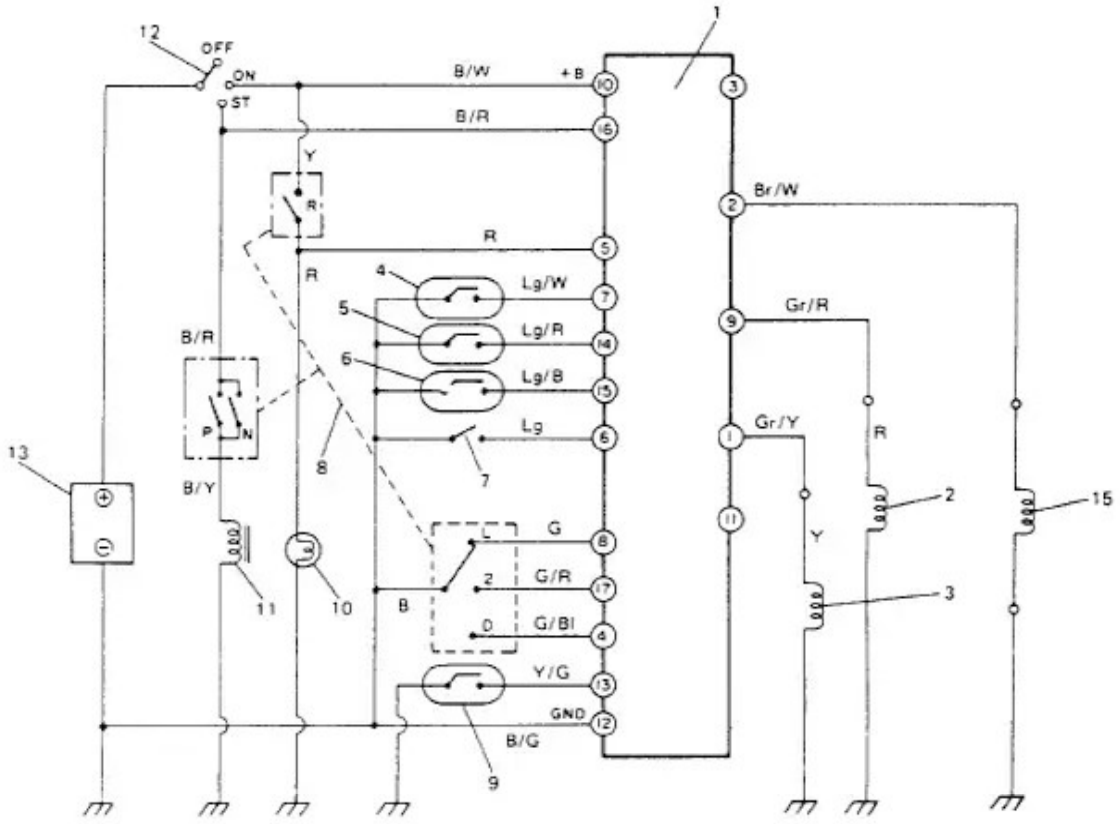
Wiring diagram of gear shift control system

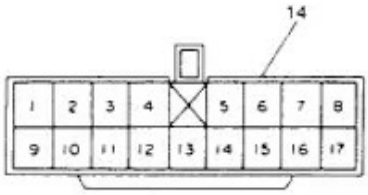
Page 7A1-45 shows electric circuit of gear shift control system. Referring to this circuit diagram, check each circuit of switches, solenoids and sensor for disconnection and poor contact.

NOTICE:

- **Make sure to turn "OFF" ignition switch before checking each circuit.**
- **With ignition switch turned "OFF", disconnect coupler of controller.**

For electric circuit check of each part, hold prods of ohmmeter in touch with wire connected side terminals of the disconnected coupler (on wiring harness side).
The numbers show each terminal number of the disconnected coupler (on wiring harness side) viewed from wire connected side.





1. Controller
2. Direct clutch solenoid
3. 2nd brake solenoid
4. Vacuum switch No. 1
5. Vacuum switch No. 2
6. Vacuum switch No. 3
7. Accelerator switch
8. Shift lever switch
9. Speed sensor
10. Back-up lamp
11. Starter motor
12. Ignition switch
13. Battery
14. Controller coupler (Viewed from wire connected side)
15. Idle up solenoid

Gr/Y : Gray/Yellow
Br/W : Brown/White
G/Bl : Green/Blue
R : Red
Lg : Light green
Lg/W : Light green/White
G : Green
Gr/R : Gray/Red
B/W : Black/White
B/G : Black/Green
Y/G : Yellow/Green
Lg/R : Light green/Red
Lg/B : Light green/Black
B/R : Black/Red

G/R : Green/Red
B/Y : Black/Yellow
Y : Yellow
B : Black

Wiring Diagram of Gear Shift Control System

Shift lever switch

Shift lever switch circuit check

Place selector lever in "P", "R", "N", "D", "2" or "L" range and in each range check for continuity between the following terminals of the disconnected controller coupler (on wiring harness side) respectively.

NOTICE:

For "R" range check in below table, turn ignition switch "ON" and check the voltage between terminals ⑫ and ⑤. The voltage should be about 12V.

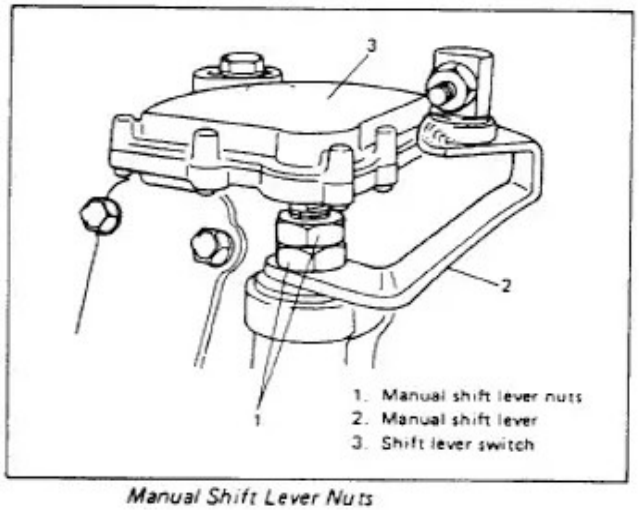
Range	Coupler terminal numbers to connect ohmmeter to:
P	⑯ – ⑫
R	⑤ – ⑫ (Volt meter)
N	⑯ – ⑫
D	④ – ⑫
2	⑰ – ⑫
L	⑧ – ⑫

Shift lever switch unit check

1. Apply parking brake and block car wheels.
2. Shift selector lever as described in the following steps. With selector lever in "P" or "N" range depending on each step, turn starter switch "ON" and check that this causes starter motor to operate, in other words, engine to start.

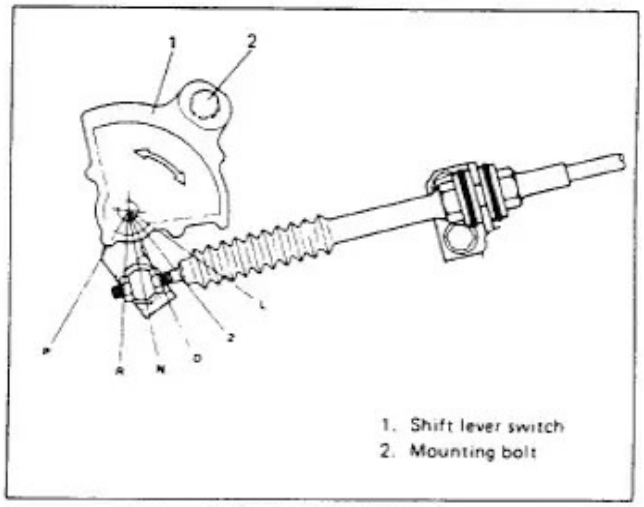
1) Shift selector lever to "P" range and turn starter switch "ON".
2) Shift selector lever from "P" to "N" and turn starter switch "ON".
3) Shift selector lever from "N" to "L", then back to "N" again and turn starter switch "ON".
4) Shift selector lever from "N" back to "P" and turn starter switch "ON".

3. If found faulty in any one of ①, ②, ③ and ④ checks in the above step 2, 2 nuts of manual shift lever may possibly be loose. So retighten these 2 nuts and then perform checks in step 2 again.



Manual Shift Lever Nuts

4. After checks in step 2, shift selector lever to "D", "2", "L" and "R" one after another. In each of these range, turn starter switch "ON" and check that this doesn't cause starter motor to operate.
5. If failure is not corrected even after retightening 2 nuts as described in step 3 or found faulty in step 4 check, loosen shift lever switch mounting bolt and then, with selector lever shifted to "N" range, move shift lever switch by hand as shown in below figure. Stop the shift lever switch at the position where a "Click" is heard from the switch, and then, retighten the mounting bolt. Be sure to perform checks in step 2 and step 4 after retightening mounting bolt.



Adjusting Shift Lever Switch Position

6. If faulty condition still exists even after adjusting shift lever switch position as described in step 5, there may possibly be a poor contact within shift lever switch. Check for continuity in switch as follows.

1) Disconnect 2 couplers of shift lever switch.
2) Shift selector lever to each range. In each range, check continuity between the shift lever switch coupler wires shown in the table by using ohmmeter. If found faulty, replace shift lever switch.

Direct clutch and 2nd brake solenoids

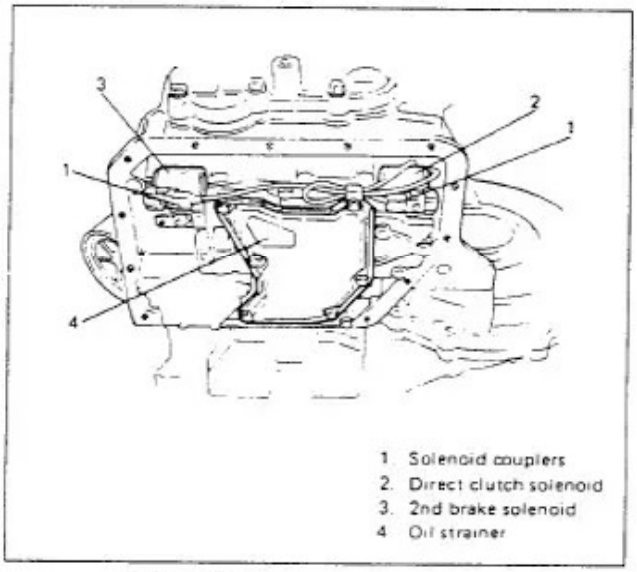
Solenoid circuit check

1. With ignition switch turned "OFF", disconnect controller coupler.
2. Measure resistance between the following coupler terminals. Both circuit should register about 13 ohms.

Solenoid	Coupler terminal numbers to connect ohmmeter to:
Direct clutch	⑨ – ⑫
2nd brake	① – ⑫

Solenoid unit check

1. Drain fluid from transaxle.
2. Remove transaxle oil pan.
3. Disconnect solenoid couplers at each solenoid.



Solenoid Couplers

4. Connect ohmmeter between solenoid terminal and solenoid body and measure solenoid resistance. If about 13 Ω resistance exists, solenoid is in good condition.
5. Connect positive terminal of 12V battery to solenoid terminal and negative terminal to solenoid body. Check that a click of valve operation is heard from solenoid when connection is made.

NOTICE:

Make sure not to reverse positive and negative terminals of battery when connecting them to solenoid.

6. If found faulty in step 4 or 5 check, replace solenoid.
7. After checking, connect coupler to solenoid.
8. After installing oil pan, refill transaxle.

Vacuum switches (No. 1, No. 2 and No. 3)

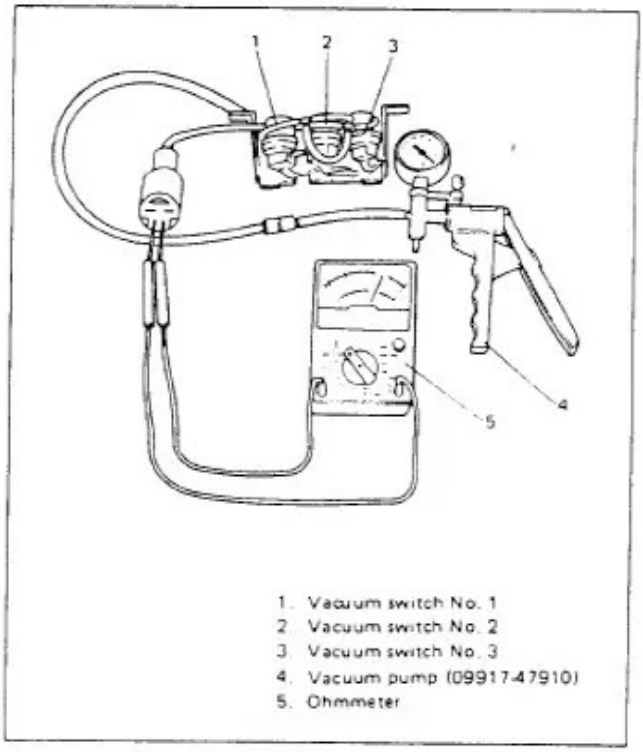
Vacuum switch circuit check

1. With ignition switch turned "OFF", disconnect controller coupler.
2. Check for continuity between the following coupler terminals.

Vacuum switch	Coupler terminal numbers to connect ohmmeter to:
No. 1	⑦ – ⑫
No. 2	⑭ – ⑫
No. 3	⑬ – ⑫

Vacuum switch unit check

1. Disconnect vacuum hose and electric wire coupler of vacuum switch.
2. Remove vacuum switch from dash panel.
3. Check vacuum switches (No. 1, No. 2 & No. 3) for proper operation by using vacuum pump and ohmmeter.
   Vacuum switch is in good condition if ohmmeter pointer indicates 0 Ω when no vacuum is applied and it moves from 0 Ω to ∞ Ω when specific vacuum as given below is applied to each vacuum switch.
4. If found faulty in step 3 check, replace switch.
5. Reinstall vacuum switch to dash panel and connect vacuum hose and coupler.



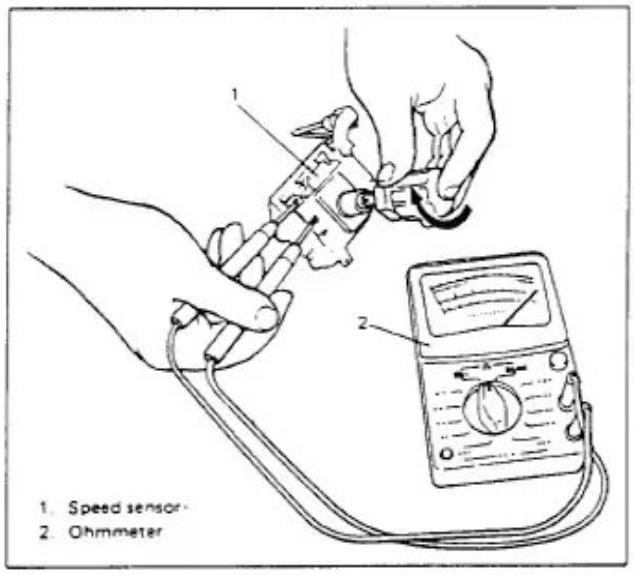
Checking Vacuum Switches with Vacuum Applied

Vacuum switch	Wires to connect ohmmeter	Vacuum to apply (mm Hg)	Ohmmeter pointer indication
No. 1	Yellow wire and Black wire	0	0 Ω
		290 – 310	From 0 Ω to ∞ Ω
No. 2	Green wire and Black wire	0	0 Ω
		190 – 210	From 0 Ω to ∞ Ω
No. 3	Blue wire and Black wire	0	0 Ω
		90 – 110	From 0 Ω to ∞ Ω

Speed sensor

1. Remove instrument cluster bezel.
2. Remove instrument cluster ass'y from instrument panel.
3. Remove speedometer.
4. Using ohmmeter, check speed sensor.

Connect ohmmeter to 2 terminals of speed sensor which is installed on the back of speedometer. Ohmmeter pointer indicates either 0 Ω or ∞ Ω in this state.



Checking Speed Sensor

5. In the same state as in step 4, turn speedometer cable joint one full turn clockwise gradually. During this turn, check that ohmmeter pointer deflects toward ∞ Ω or 0 Ω 4 times. If ohmmeter pointer was at 0 Ω before turning speedometer cable joint, it deflects toward ∞ Ω 4 times during one turn, and if it was at ∞ Ω, it deflects toward 0 Ω 4 times.
6. If found faulty, replace speedometer.
7. Reinstall removed parts and connect couplers.

ON VEHICLE SERVICE

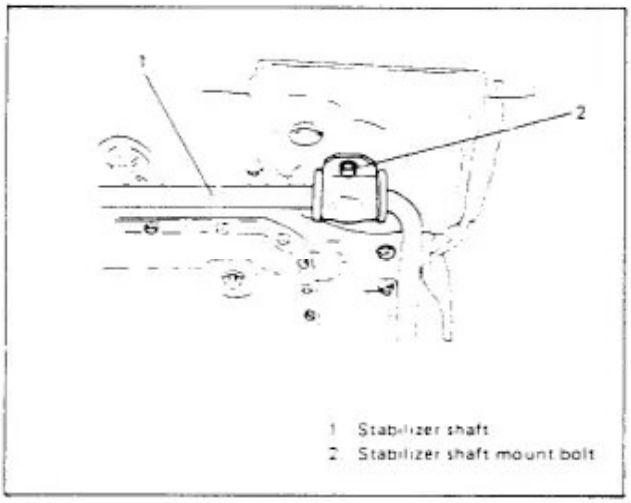
OIL PAN GASKET

Remove or Disconnect

1. Raise car and drain transaxle fluid.

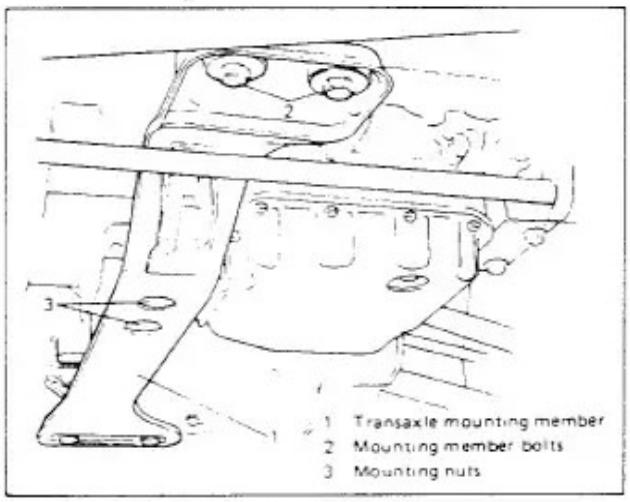
NOTICE:
With some cars, oil pan can be removed and reinstalled smoothly in this state. If so, steps 2, 3 and 4 need not be performed.
But if it can't be removed or reinstalled smoothly, be sure to follow these steps. Attempt to remove or reinstall oil pan forcibly without these steps will damage oil pipes, mating surface of oil pan and so on.

2. Stabilizer shaft mount bolts.



Stabilizer Shaft Mount Bolts

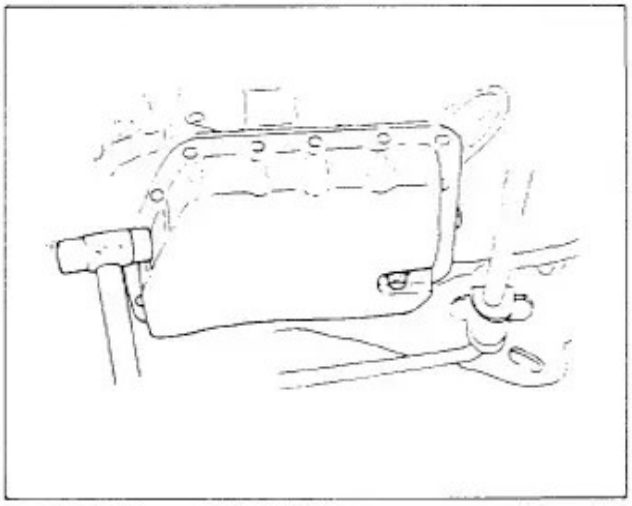
3. Transaxle mounting member.



Transaxle Mounting Member

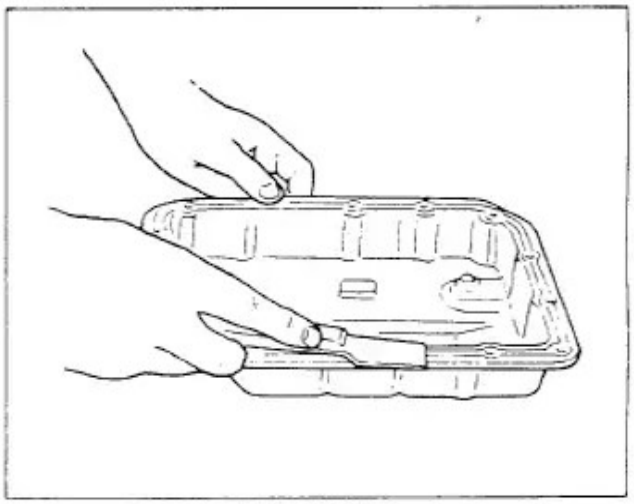
4. Loosen transaxle mounting bolts.
5. Oil pan from transaxle.
   After removing oil pan bolts, tap around oil pan lightly with a plastic hammer for removal.

NOTICE:
- Never hammer oil pan hard, or it may be deformed.
- Do not force oil pan off by using a flat tip screwdriver or the like as it may cause damage to gasketed surface.



Removing Oil Pan

6. Oil pan gasket.
   Remove gasket on mating surface thoroughly.

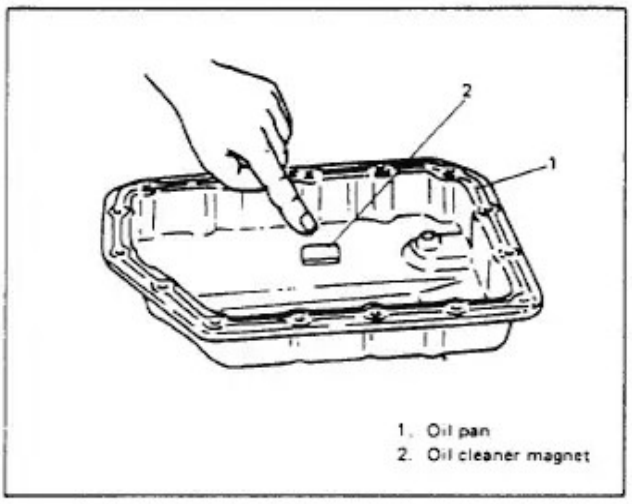


Removing Oil Pan Gasket

Install or Connect

For oil pan installation, reverse its removal procedure using care for the following.

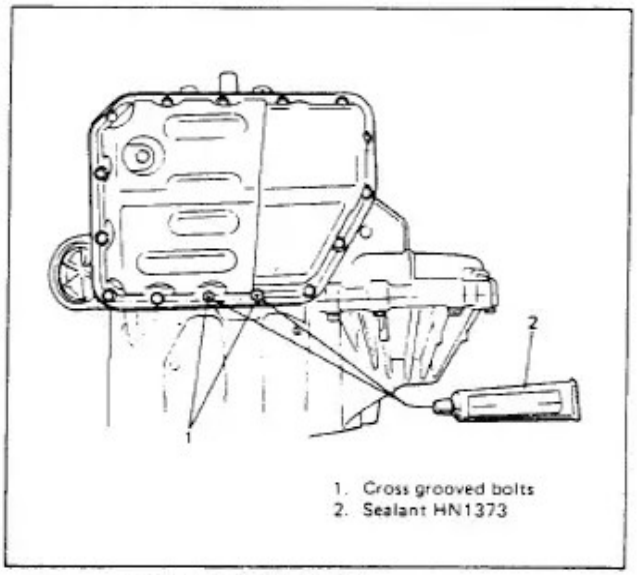
1. Make sure to use new gasket.
2. Clean inside of oil pan before installation.
3. Clean oil cleaner magnet and install it in the position right below oil strainer.



Oil Cleaner Magnet Installation

4. There are 15 oil pan securing bolts in all and two of them have cross groove in their heads. Mount these cross grooved bolts in such positions as shown in figure after applying sealant to their threads. However, do not apply sealant to other 13 bolts.
   Tighten oil pan bolts to the following torque one after another diagonally.
   Be sure not to over-tighten.

Oil pan bolt Tightening torque	4 – 6 N·m 0.4 – 0.6 kg·m 3.0 – 4.0 lb·ft



Oil Pan Bolt Installation

5. Tighten transaxle mounting member bolts, mounting nut and stabilizer shaft mount bolts to the specifications.

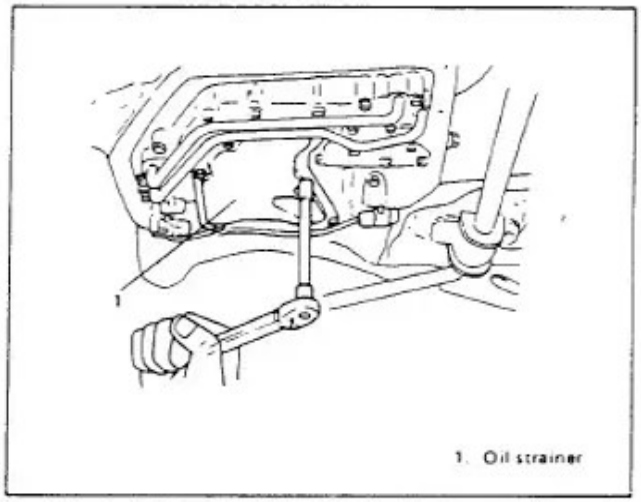
Bolt or nut	Tightening torque
Transaxle mounting member bolts	50 – 60 N·m 5.0 – 6.0 kg·m 36.5 – 43.0 lb·ft
Mounting nut	40 – 50 N·m 4.0 – 5.0 kg·m 29.0 – 36.0 lb·ft
Stabilizer shaft mount bolts	30 – 55 N·m 3.0 – 5.5 kg·m 22.0 – 39.5 lb·ft

6. Upon completion of installation, warm up transaxle and check for oil leakage.

OIL STRAINER

Remove or Disconnect

1. Drain transaxle fluid.
2. Remove oil pan.
3. Remove oil strainer.



Oil Strainer

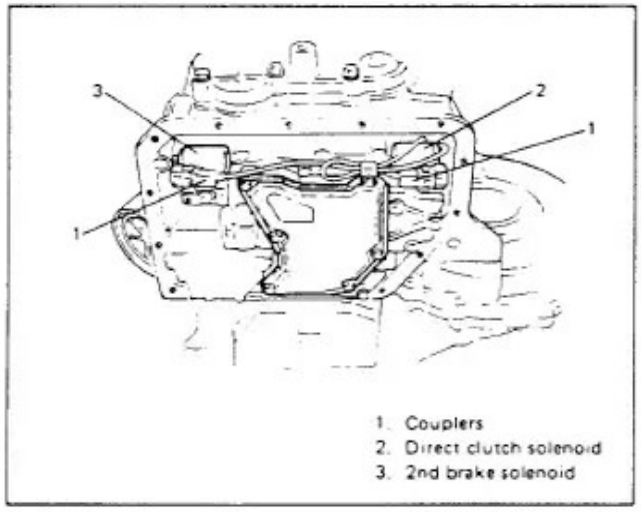
Install or Connect

1. Clean oil strainer.
2. Oil strainer to lower valve body. Tighten oil strainer bolts to 5 – 6 N·m (0.5 – 0.6 kg·m, 3.7 – 4.3 lb·ft).
3. Reinstall oil pan and refill transaxle fluid.
4. Upon completion of installation, warm up transaxle and check for oil leakage.

DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS, AND SOLENOID WIRE HARNESS

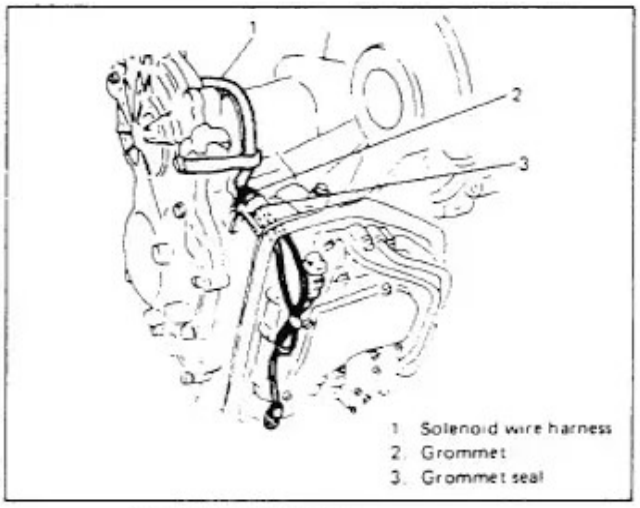
Remove or Disconnect

1. Drain transaxle fluid and remove oil pan.
2. Couplers from direct clutch and 2nd brake solenoids, and then solenoids themselves.



Solenoids

3. Solenoid wire harness with grommet from upper side.



Solenoid Wire Harness

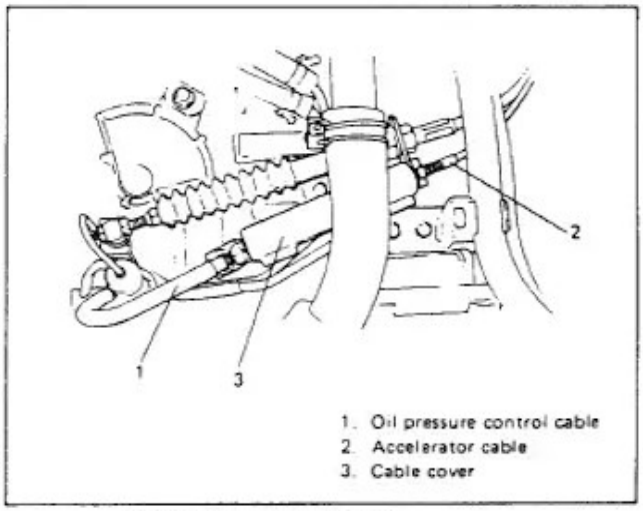
Install or Connect

1. Solenoid wire harness to transaxle case. If grommet seal ("O" ring) is damaged, replace it. See above figure for grommet and seal ("O" ring).
2. Direct clutch and 2nd brake solenoids to lower valve body. If solenoid seal ("O" ring) is damaged, replace it.
3. Solenoid wires to each solenoid.
4. Oil pan to transaxle and then refill transaxle fluid.
5. Solenoid wire harness coupler.
6. Upon completion of installation, warm up transaxle and check for oil leakage.

OIL PRESSURE CONTROL CABLE

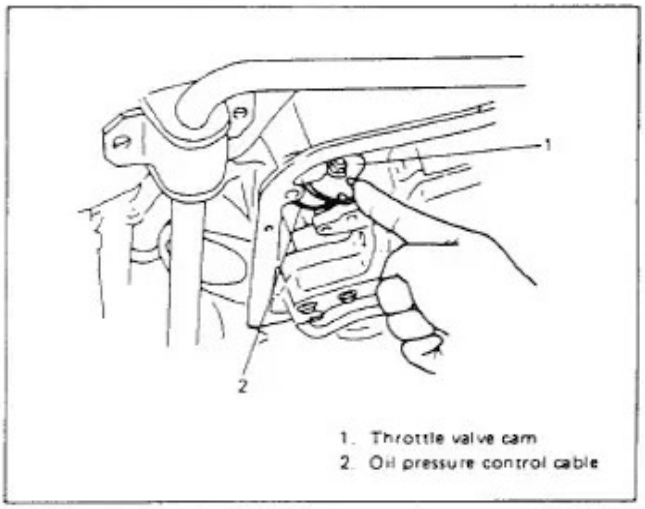
Remove or Disconnect

1. Oil pressure control cable from accelerator cable after removing cable cover.



Oil Pressure Control Cable

2. Drain transaxle fluid.
3. Oil pan.
4. Oil pressure control cable from throttle valve cam.
5. Oil pressure control cable from transaxle case.



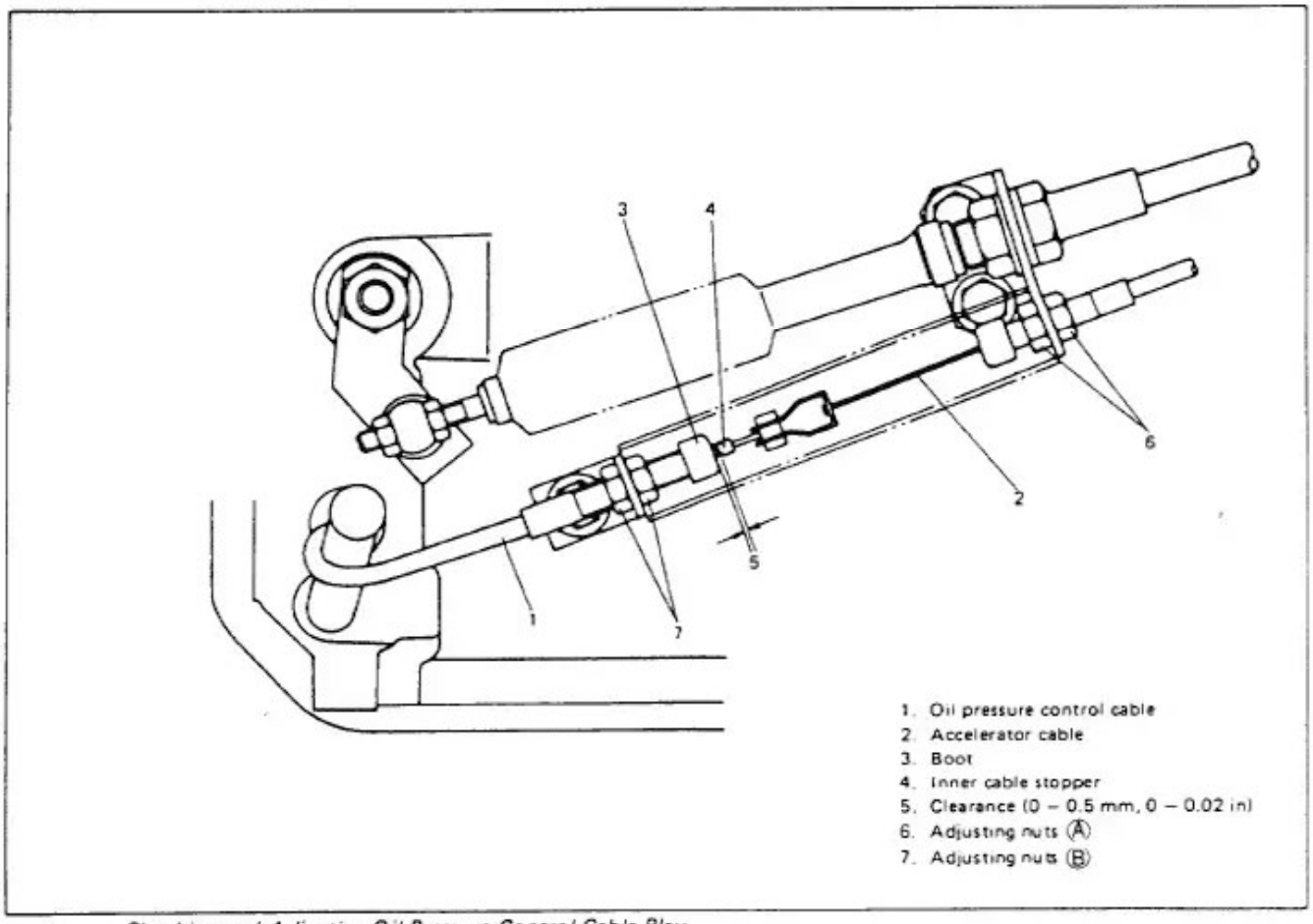
Throttle Valve Cam

Install or Connect

Reverse the removal procedure for installation. After connecting oil pressure control cable to accelerator cable, check and adjust oil pressure control cable play.

Checking and Adjusting Oil Pressure Control Cable Play

1. Check accelerator cable for play and adjust if necessary.
2. Warm up engine and run it at idle. Then check to ensure that idle up is not at work.
3. After removing oil pressure control cable cover, check that boot-to-inner cable stopper clearance shown in below figure is within 0 – 0.5 mm (0 – 0.02 in) by using thickness gauge.
4. If measured clearance is out of specification, loosen adjusting nuts Ⓐ and adjust by turning them. If attempt to adjust clearance to specification by turning adjusting nuts Ⓐ fails, try to adjust with adjusting nuts Ⓑ. Tighten nuts after adjustment.
5. Install cover after check and adjustment.



Checking and Adjusting Oil Pressure Control Cable Play

MANUAL SELECTOR

Remove or Disconnect

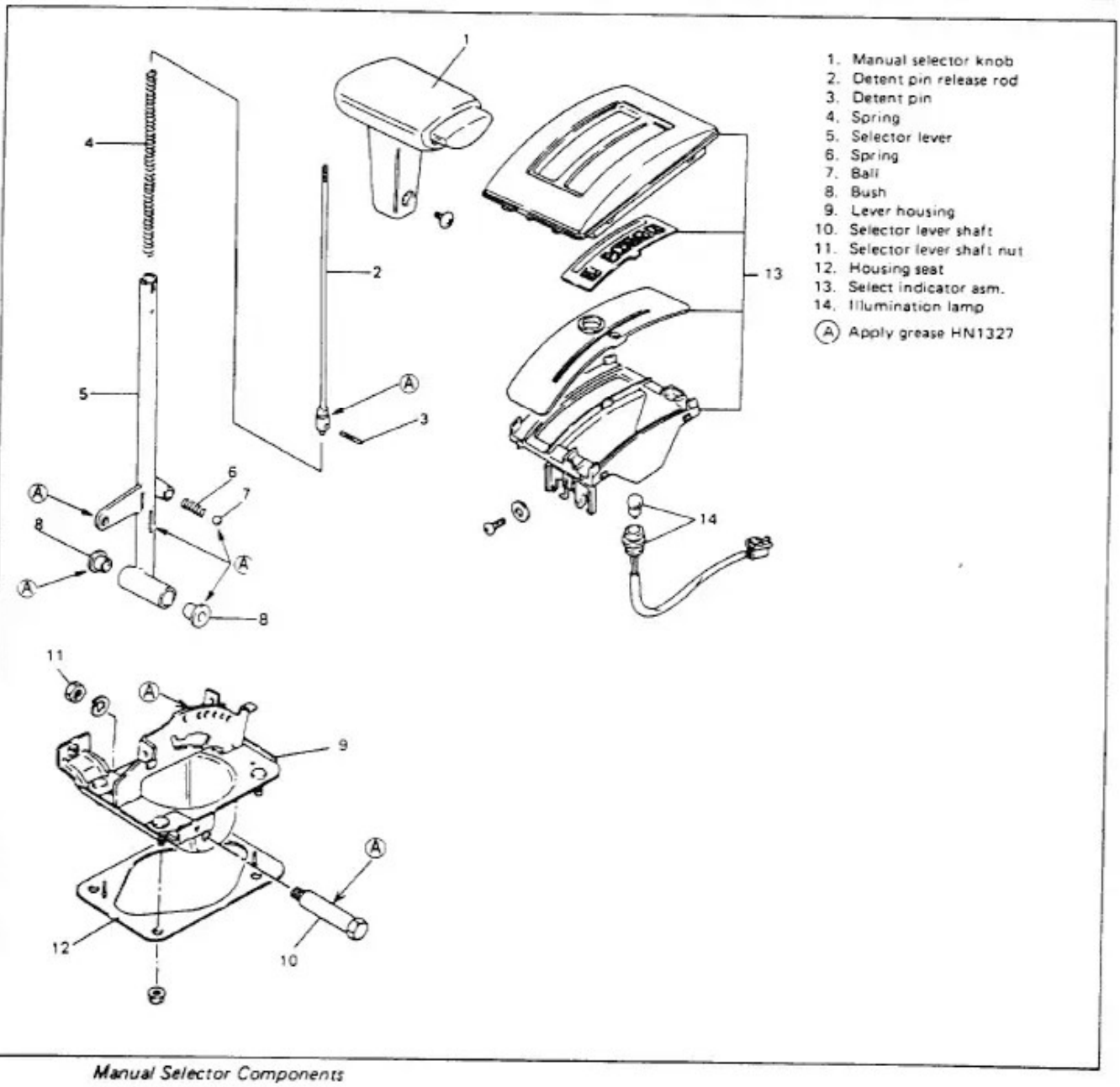
1. Selector knob screw and then selector knob by turning counterclockwise.
2. Console box.
3. Select indicator ass'y.
4. Select cable from selector lever.
5. Raise car.
6. Housing seat after removing four housing nuts.
7. Lever housing with selector lever from floor.

Install or Connect

Reverse the removal procedure for installation.

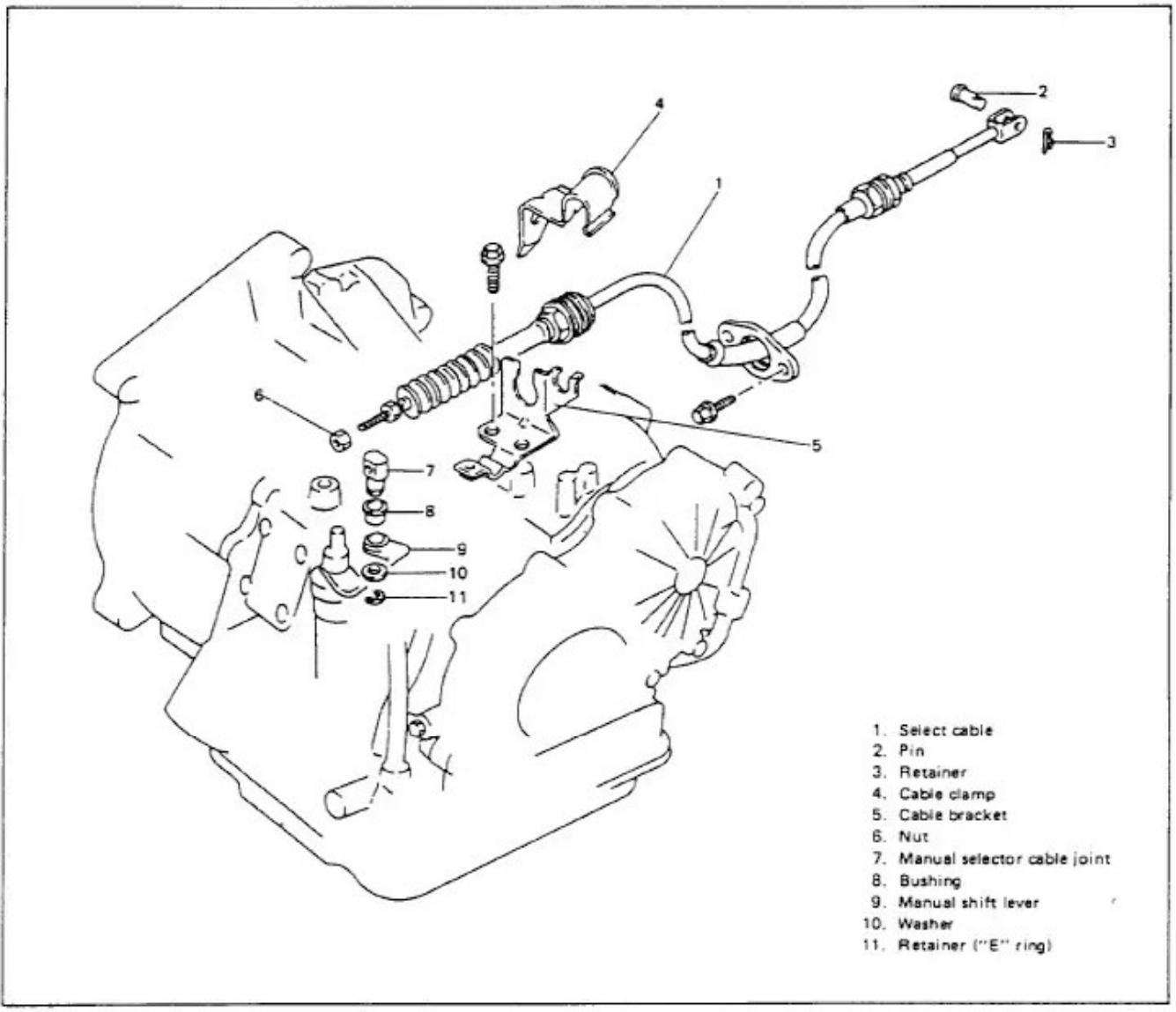
- Apply grease to the positions indicated as Ⓐ in below figure.
- Tighten nuts to the specification.

Nut	Tightening torque
Selector lever shaft nut	18 – 22 N·m 1.8 – 2.2 kg-m 13.0 – 15.5 lb-ft
Lever housing nuts	10 – 16 N·m 1.0 – 1.6 kg-m 7.5 – 11.5 lb-ft



Manual Selector Components

SELECT CABLE



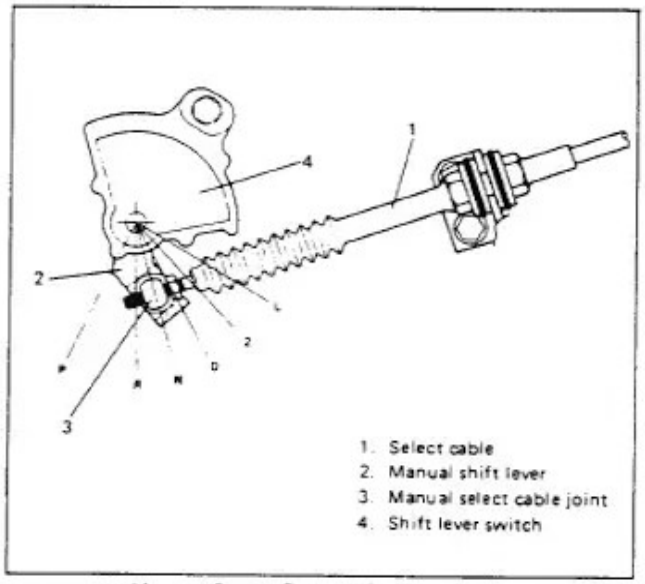
Select Cable Components

Remove or Disconnect

1. Console box.
2. Select indicator.
3. Select cable from selector lever and then from floor.
4. Select cable from transaxle.
5. Raise car.
6. Select cable from front panel.

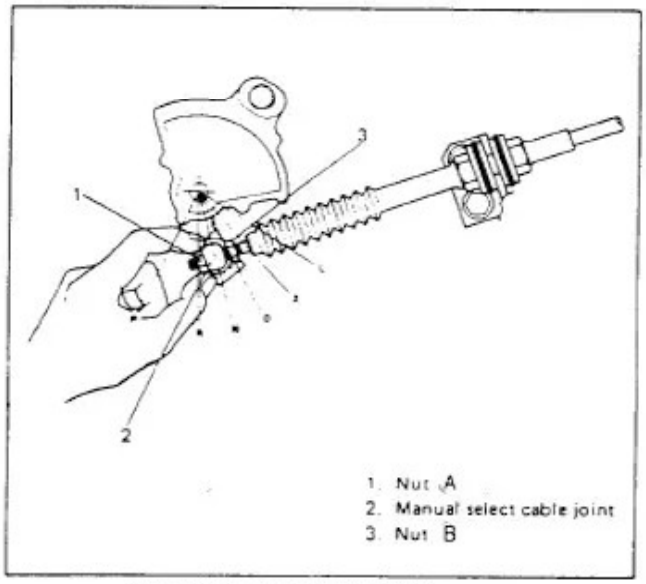
Install or Connect

1. Raise car.
2. Select cable to front panel.
3. Lower car.
4. Select cable to floor.
5. Select cable to selector lever after greasing select cable pin.
6. Select indicator to lever housing.
7. Console box.
8. Select cable to select cable bracket on transaxle.
9. Select cable into manual select cable joint hole, and then, shift manual shift lever to "N" range.



Manual Select Cable Joint and Manual Shift Lever in "N" Range

10. With selector lever shifted to "N" range, turn nut Ⓐ in figure by hand till it contacts manual select cable joint. Then tighten nut Ⓑ with wrench.



Select Cable Nuts (Ⓐ & Ⓑ)

11. After select cable was installed, check for the following.
- Push car with selector lever shifted to "P" range. Car should not move.
- Car can not be driven in "N" range.
- Car can be driven in "D", "2" and "L" ranges.
- Car can be backed in "R" range.

SHIFT LEVER SWITCH

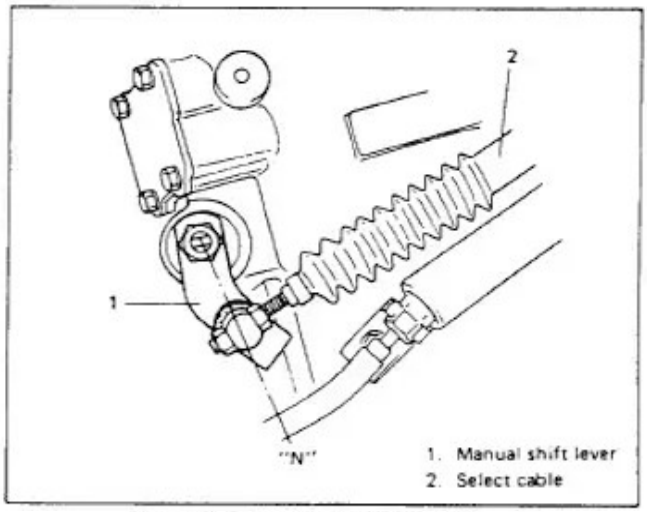
NOTICE:
Do not overhaul shift lever switch.

Remove or Disconnect

1. Shift lever switch couplers.
2. Shift lever switch from transaxle.

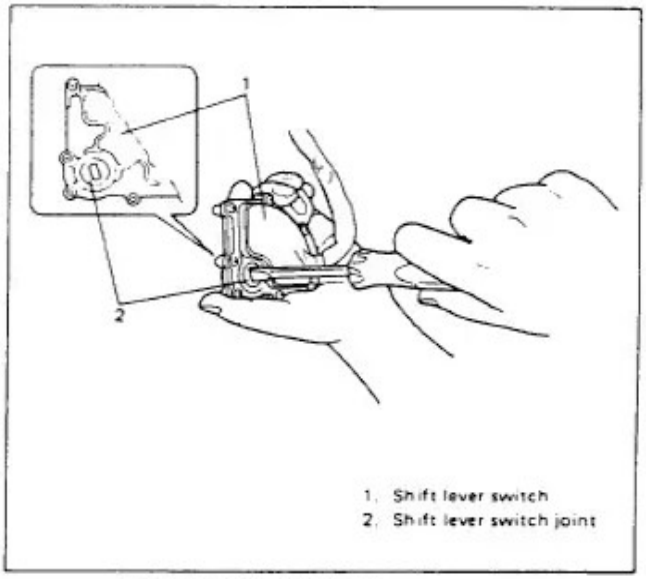
Install or Connect

1. Shift manual shift lever to "N" range, that is, to shift selector lever to "N" range.



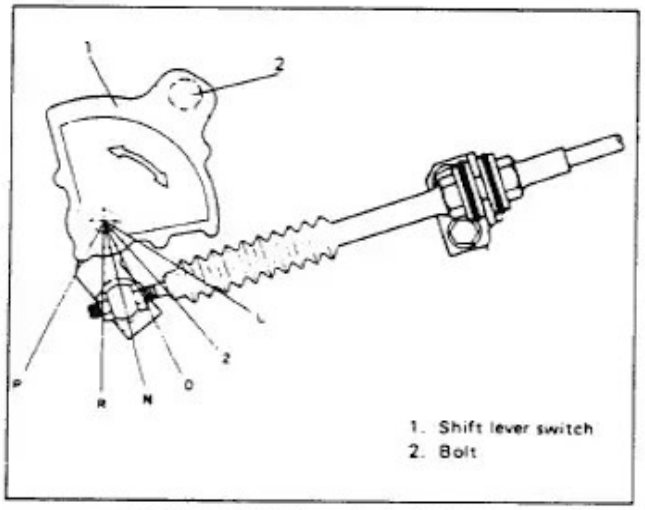
Manual Shift Lever in "N" Range

2. Using flat head screwdriver, turn shift lever switch joint clockwise or counterclockwise to the position shown in figure and check that a "click" is heard from joint at this position.



Shift Lever Switch Joint

3. After installing shift lever switch to manual shift shaft, move shift lever switch by hand in arrow direction as shown in figure. Stop at the position where a "click" from joint is heard or felt by hand and then secure it by tightening bolt to 13 – 23 N·m (1.3 – 2.3 kg·m, 9.5 – 16.5 lb·ft) torque.



Adjusting Shift Lever Switch Position

4. Couplers and clamp.
5. Upon completion of shift lever switch installation, check for its proper installation according to the following.
   1) Apply parking brake and block car wheels.
   2) With selector lever shifted to "P" range, turn starter switch "ON" and check that this causes starter motor to operate.
   3) Shift selector lever from "P" to "N" range, turn starter switch "ON" and check that this causes starter motor to operate.
   4) Shift selector lever from "N" to "L" and then back to "N" range, turn starter switch "ON" and check that this causes starter motor to operate.
   5) Shift selector lever from "N" to "P" range and check starter motor for operation as in step 4).
   6) Check to make sure that in any other range than "P" and "N", starter motor doesn't operate even when starter switch is turned "ON".
   7) Turn ignition switch "ON" (without starting engine) and shift selector lever to "R" range. Then check that back up lamps light.
6. If any check result was unsatisfactory in step 5, remove shift lever switch and perform steps 1 to 4 all over again.

TRANSAXLE ASSEMBLY

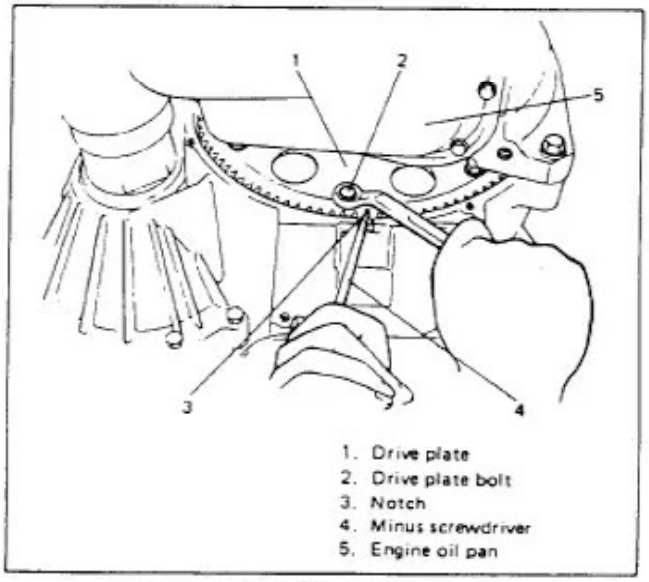
Remove or Disconnect

1. Disconnect negative cable from battery.
2. To take down engine with transaxle from car body, remove or disconnect hoses, pipes, electric wires, cables and parts.
3. Disconnect drive axle (L) from differential side gears of transaxle and drive axle (R) from drive axle inner shaft.

   For engine and transaxle removal, it is not necessary to remove the drive axle from steering knuckle.
4. Install lifting device.

NOTICE:
Before lifting engine with transaxle, recheck to ascertain all hoses, electric wires and cables are disconnected from engine and transaxle.

5. Take down engine with transaxle.
6. Remove transaxle case housing lower plate.
7. Remove six (6) drive plate bolts. To lock drive plate, engage a minus screwdriver with the drive plate gear through the notch provided at under side of transaxle case.



Removing Drive Plate Bolts

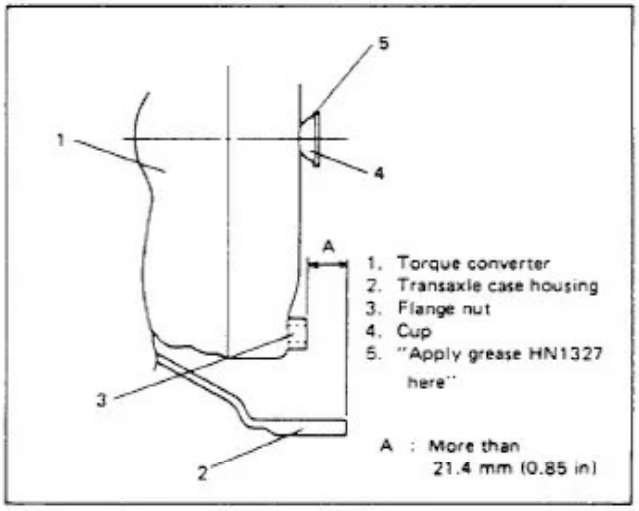
8. Remove bolts and nut fastening engine and transaxle, and remove transaxle from engine.

NOTICE:
- **When removing transaxle ass'y from engine, move it in parallel with crankshaft and use care so as not to apply excessive force to drive plate and torque converter.**
- **After removing transaxle ass'y, be sure to keep it so that oil pan is at the bottom. If transaxle is tilted, fluid in it may flow out.**

Install or Connect

Reverse the removal procedure. The important steps in installation are as follows.

- Before mounting transaxle assembly:
  a) Apply grease around the cup at center of torque converter (Refer to below figure).
  b) Measure the distance A shown in below figure. The distance should be more than 21.4 mm (0.85 in). If it is less than 21.4 mm (0.85 in), it means that the torque converter is improperly installed. Therefore, in such a case, remove the torque converter, and then, reinstall it for proper installation.



Torque Converter Installation

- Tighten six (6) drive plate bolts 1.8 – 1.9 kg-m (18 – 19 N-m, 13.0 – 14.0 lb-ft).
- Lower engine with transaxle into car body and tighten engine and transaxle mounting nuts and bolts, and remove lifting device.
- After installing drive axles (R & L) into differential side gear of transaxle and drive axle inner shaft, tighten ball stud bolts and stabilizer bar mount bracket bolts to specifications.
- Adjust accelerator cable play.
- After connecting oil pressure control cable to accelerator cable, check oil pressure control cable play and adjust if necessary as previously described.
- Install select cable as described
- Refill engine coolant to specified level.
- Refill transaxle and check the fluid level.
- Before starting engine, check again to ensure that all parts once disassembled or disconnected are back in place securely.
- After engine is started, check for oil leak, abnormal noise and other malcondition. Also, check each part for operation.

UNIT REPAIR

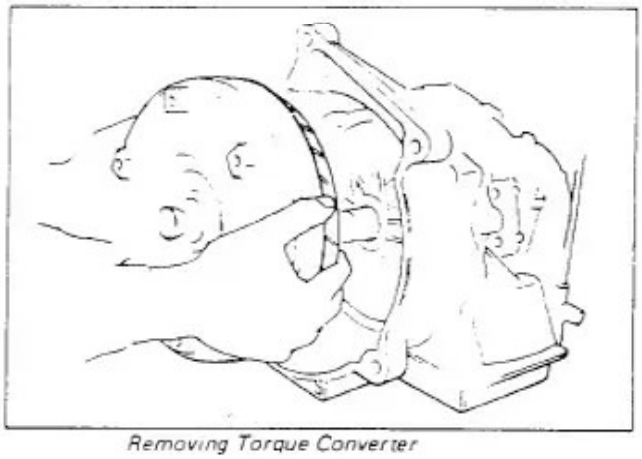
DISASSEMBLY OF TRANSAXLE

NOTICE:

- Before overhauling transaxle, clean it thoroughly so as to prevent its inner parts against dust and dirt during overhaul.
- When placing removed transaxle on working table, be sure to put a soft mat on table so as not to damage outside parts of transaxle.
- Use special care for gasket removal. Gasket must be removed completely and gasketed surface must not be damaged.
- When removing snap ring, be careful not to damage any other part.
- When removing bearing, do not apply force to bearing ball or roller.
- Do not remove parts more than necessary.
- Be careful not to expose removed parts to dust and dirt. Keep removed parts clean always.

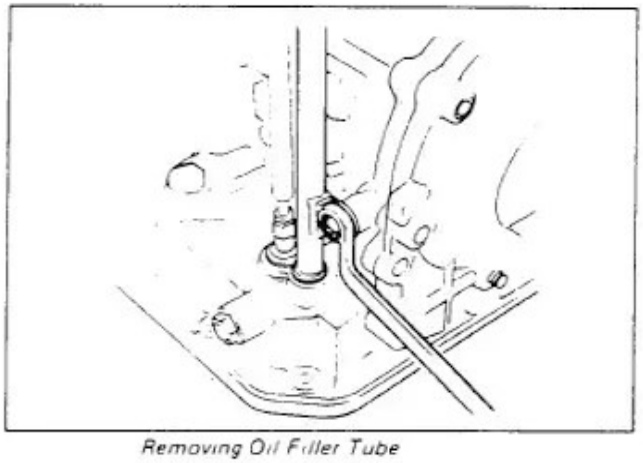
Remove or Disconnect

1. Torque converter.



Removing Torque Converter

2. Oil level gauge and oil filler tube.



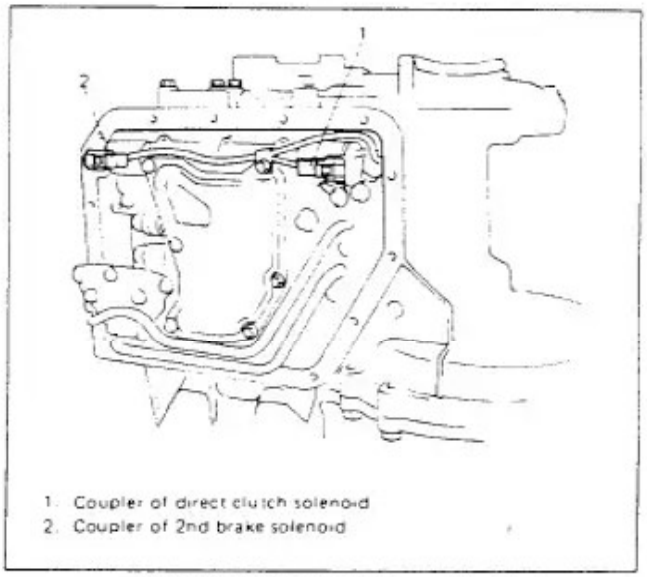
Removing Oil Filler Tube

3. Drain transaxle fluid.
   To drain fluid better, tilt transaxle in various directions.
4. Oil pan and oil pan gasket.

NOTICE:

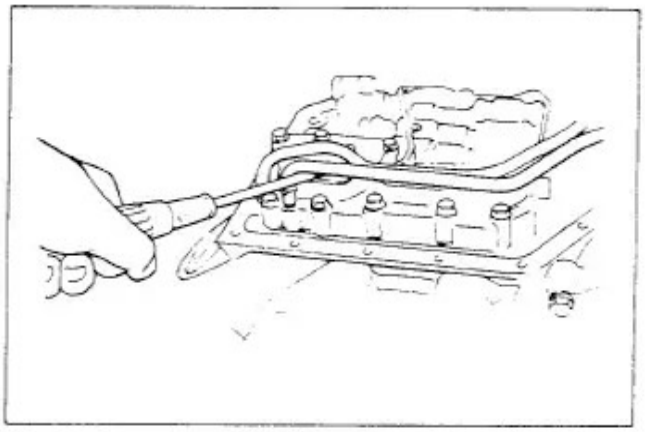
- For removal of oil pan, do not turn transaxle over as this will contaminate valve body with foreign matters in the bottom of oil pan.
- When removing oil pan, tap around it lightly with a plastic hammer. Do not force it off by using a screwdriver and the like.

5. Couplers of direct clutch and 2nd brake solenoids.



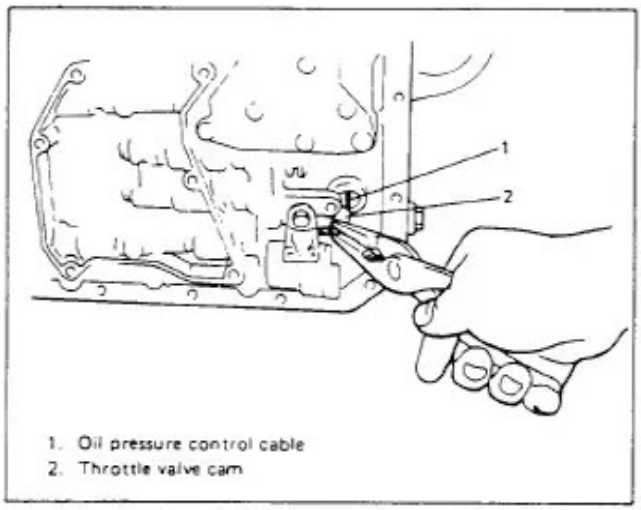
Couplers of Direct Clutch and 2nd Brake Solenoids

6. Two oil tubes from lower valve body.
   Remove them by pulling up tube end with a screwdriver.



Removing Oil Tubes

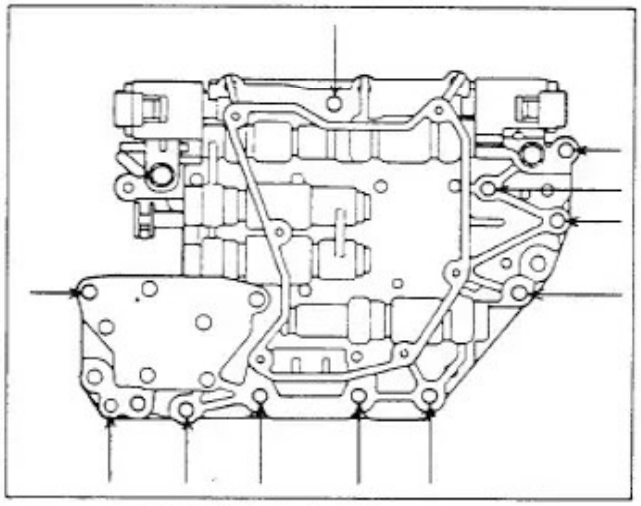
7. Oil pressure control cable from throttle valve cam and then cable.



1. Oil pressure control cable
2. Throttle valve cam

Removing Oil Pressure Control Cable

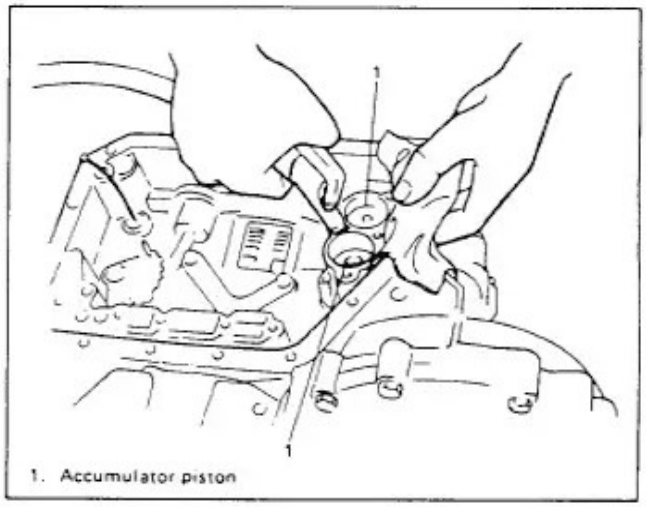
8. Oil strainer and lower valve body.
   For removal of lower valve body, remove the 11 bolts shown in figure.



Lower Valve Body Bolts

9. Accumulator pistons and spring.
   Position a rag on pistons to catch each piston. To remove pistons, force low-pressure compressed air (1 kg/cm², 15 psi, 100 kPa, max) into holes shown, and pop each piston into the rag.

NOTICE:
Do not attempt to depress accumulator pistons before removing them. Otherwise, fluid may be ejected from the fluid passage into the face of the Technician.



1. Accumulator piston

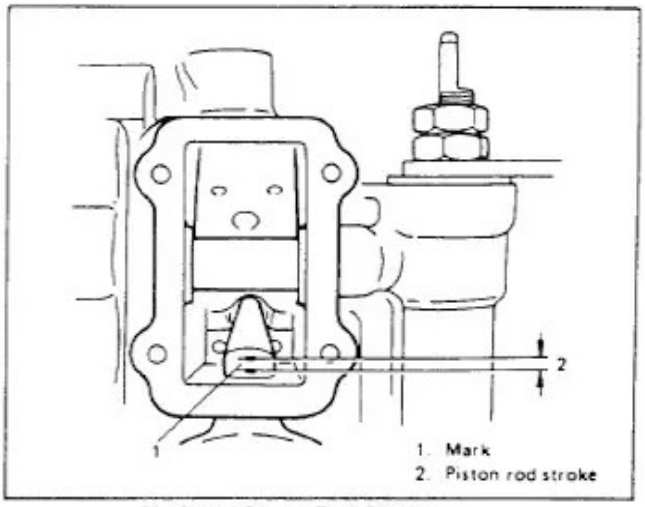
Removing Accumulator Pistons

10. Second brake band cover and gasket.
11. After removing second brake band cover, check second brake piston stroke as follows.
    1) Scribe mark on piston rod as shown in below figure.
    2) Blow air into oil hole and measure rod stroke

Second brake piston rod stroke	1.5 – 3.0 mm (0.06 – 0.11 in)

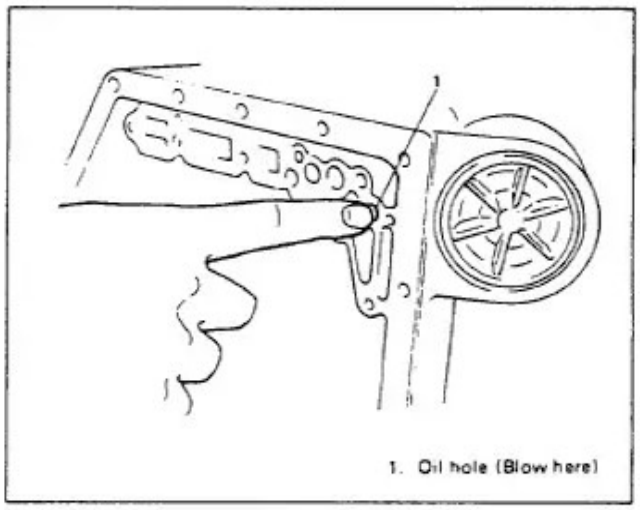
3) If out of specification, replace piston rod with the one of different length or replace second brake band.
   2nd brake piston rod of 2 different lengths are available as spare parts.

	Piston rod length	Identification mark
Available piston rod	121.3 mm (4.77 in)	Unmarked
	122.7 mm (4.83 in)	Marked

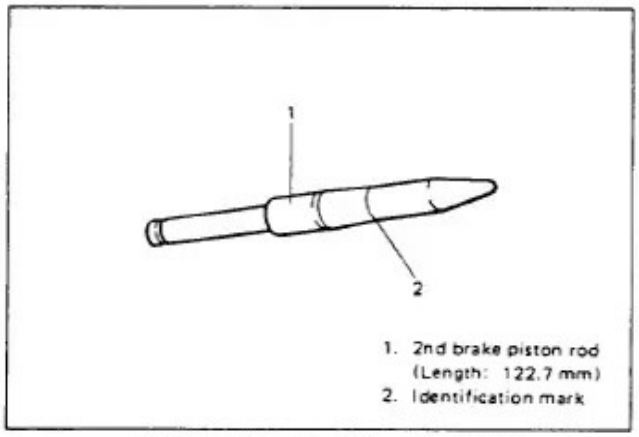


1. Mark
2. Piston rod stroke

Mark and Piston Rod Stroke

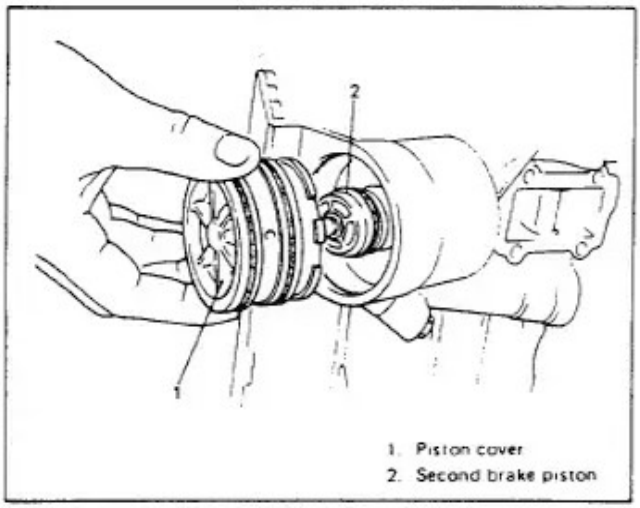


Oil Hole



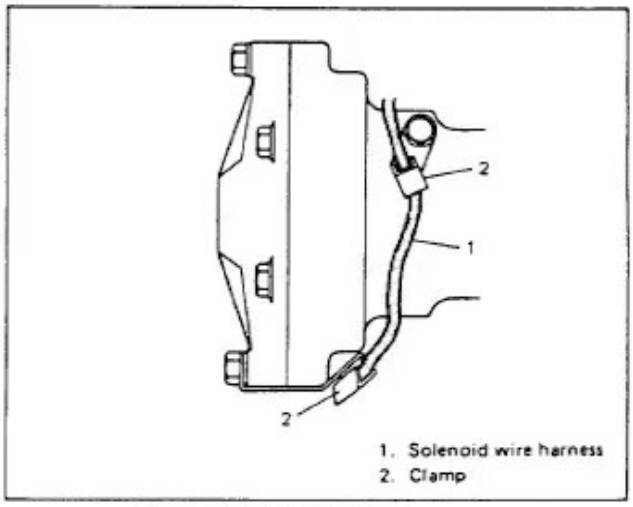
Mark on Piston Rod (Length : 122.7 mm)

12. Second brake piston (Removal is not required if second brake piston and rod are in good condition.)
Remove snap ring with a screwdriver or the like while pushing in piston cover and remove cover and piston.



Second Brake Piston

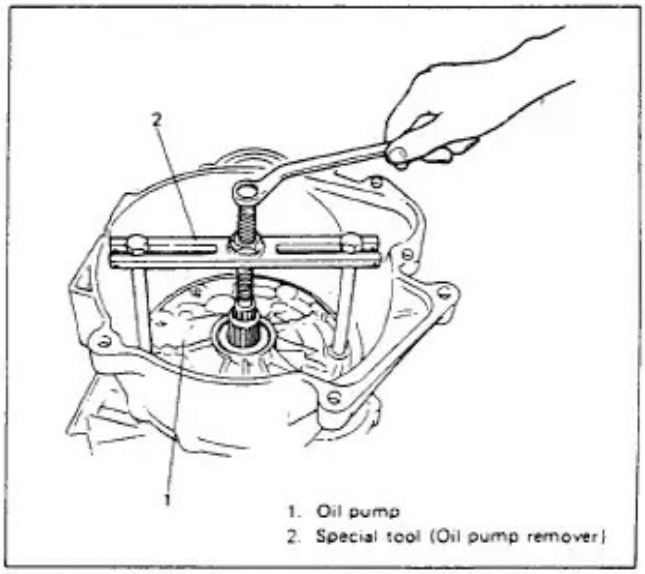
13. Solenoid wire harness.
1) Remove wire hold plate securing nut.
2) Remove 2 wire clamps on transaxle and pull out solenoid wire.



Solenoid Wire Harness

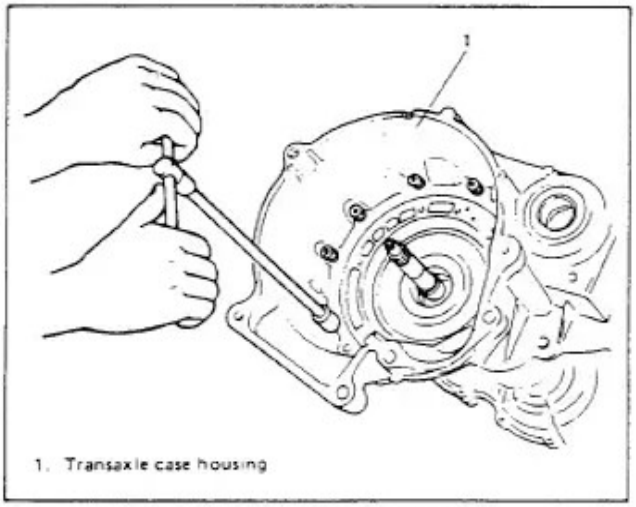
14. Oil pump
1) Remove 6 oil pump securing bolts.
2) Remove oil pump by using special tool (Oil pump remover, 09918-48210).

NOTICE:
Be careful not to loose bearing and bearing races which may sometimes stick to oil pump.



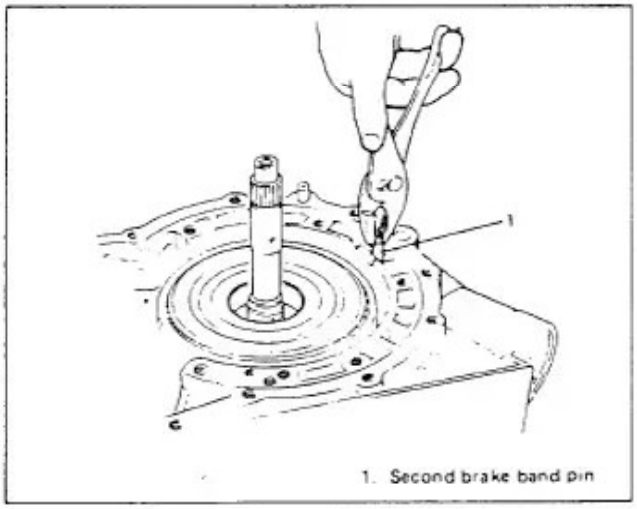
Removing Oil Pump

15. Transaxle case housing.
    1) Remove housing internal bolts and external bolts.
    2) Remove housing while tapping around it lightly with a plastic hammer.



Removing Transaxle Case Housing

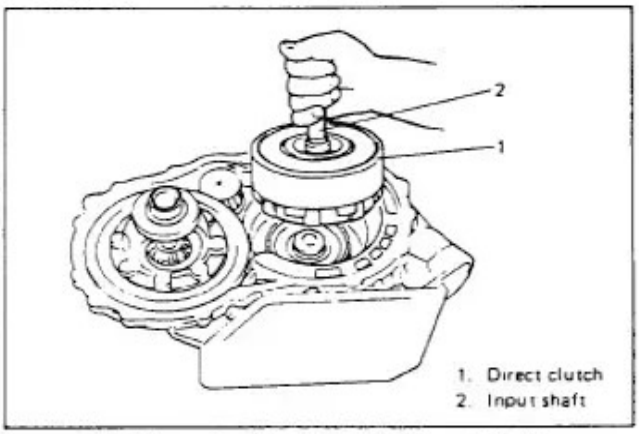
16. Second brake band pin.



Removing Second Brake Band Pin

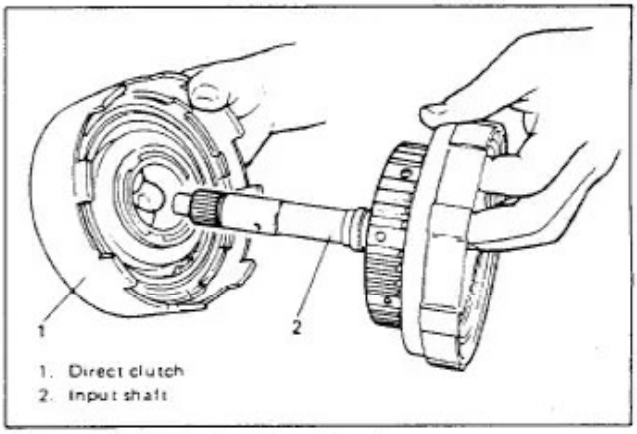
17. Direct clutch and forward clutch at the same time while holding input shaft.

NOTICE:
Be careful not to loose ring gear race and bearing which may sometimes stick to input shaft.



Removing Direct Clutch & Input Shaft

18. Direct clutch ass'y from input shaft.

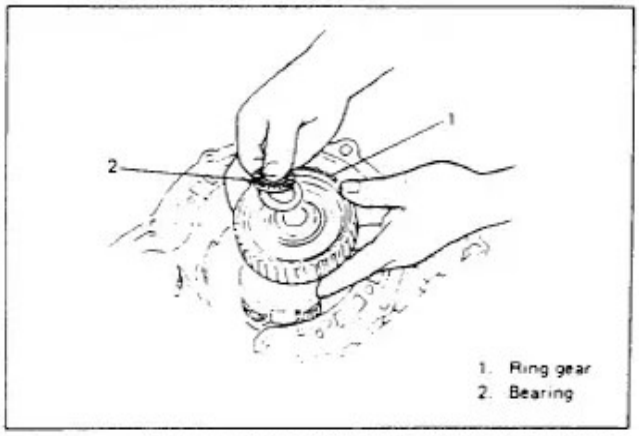


Removing Direct Clutch

19. Second brake band.

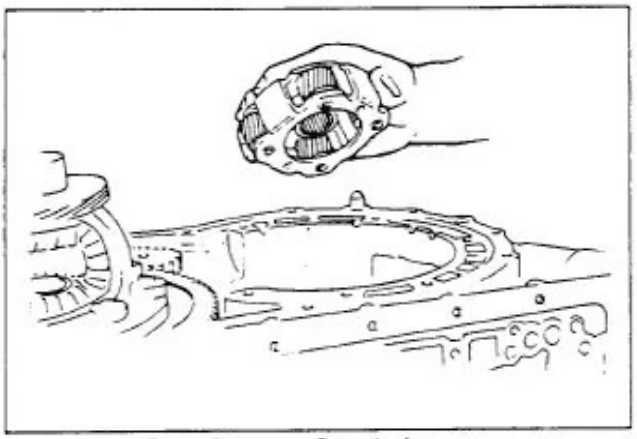
NOTICE:
Be careful not to give damage or bend to second brake band.

20. Front planetary ring gear and ring gear bearing.



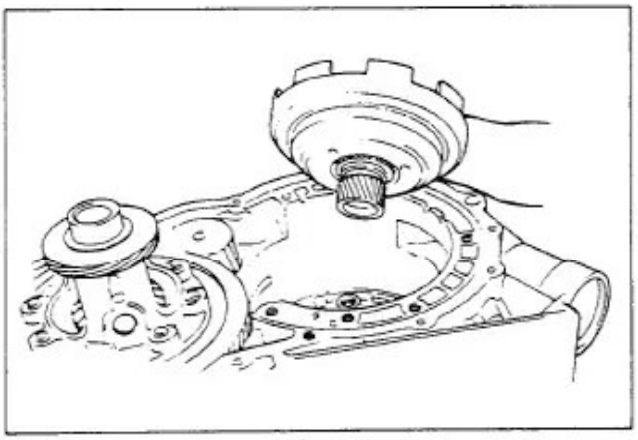
Removing Front Planetary Ring Gear & Bearing

21. Front planetary gear ass'y.



Front Planetary Gear Ass'y

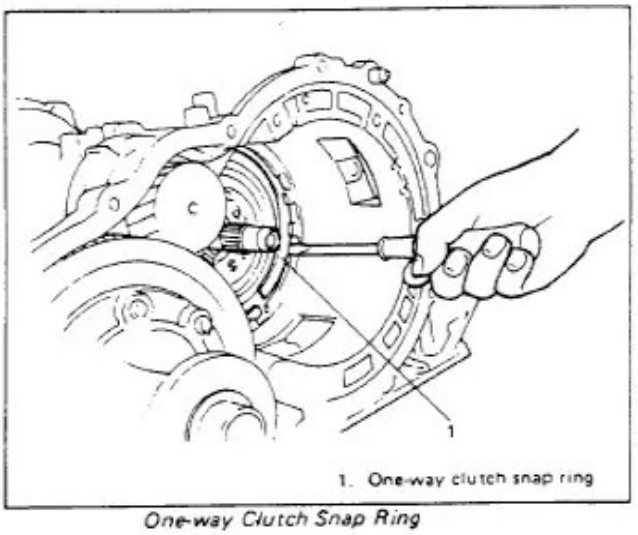
22. Planetary sun gear and front planetary gear bearing.



Planetary Sun Gear

23. One way clutch snap ring by using a screwdriver.

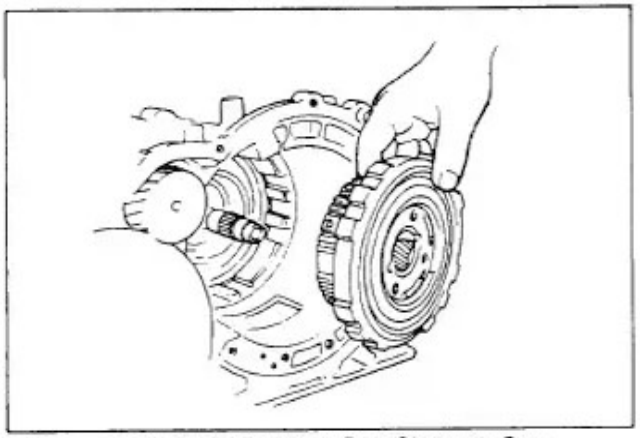
NOTICE:
Use care not to damage transaxle case when removing snap ring.



1. One-way clutch snap ring

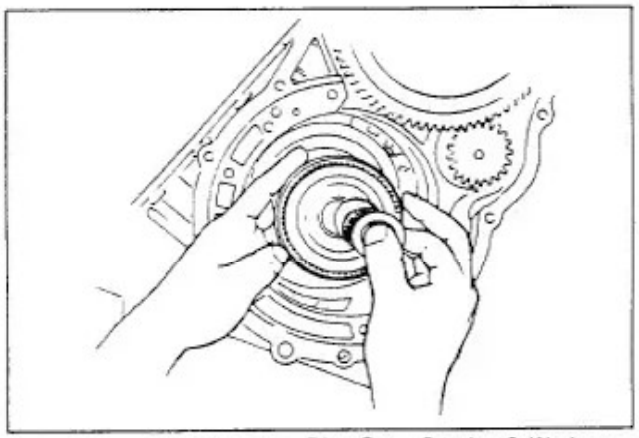
One-way Clutch Snap Ring

24. One way clutch and rear planetary gear.



One-way Clutch & Rear Planetary Gear

25. Rear planetary ring gear, ring gear bearing and washers.

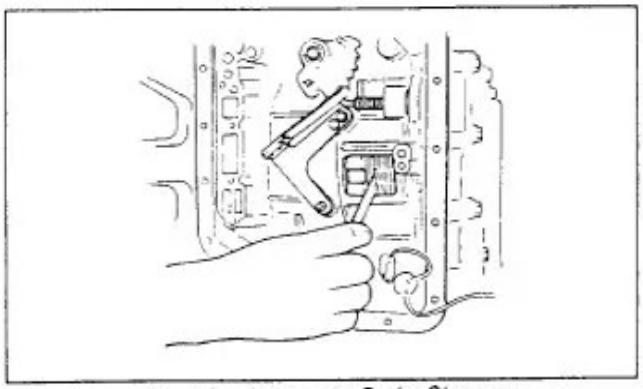


Rear Planetary Ring Gear, Bearing & Washers

26. Check 1st-reverse brake clearance.
Measure clearance between snap ring and flange with a thickness gauge.

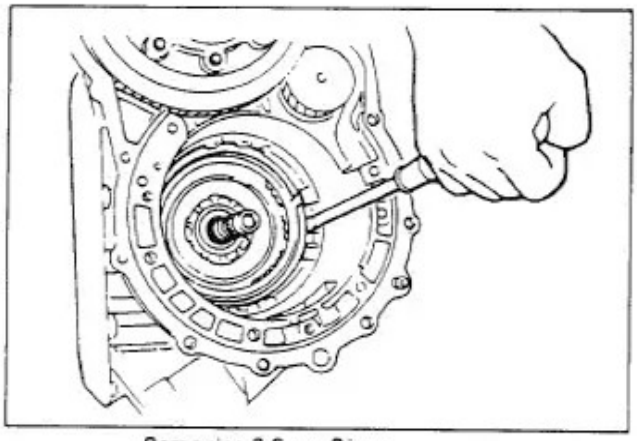
Clearance	0.58 – 1.92 mm (0.023 – 0.075 in)

If out of specification, replace 1st-reverse brake disc or plate with a new one.



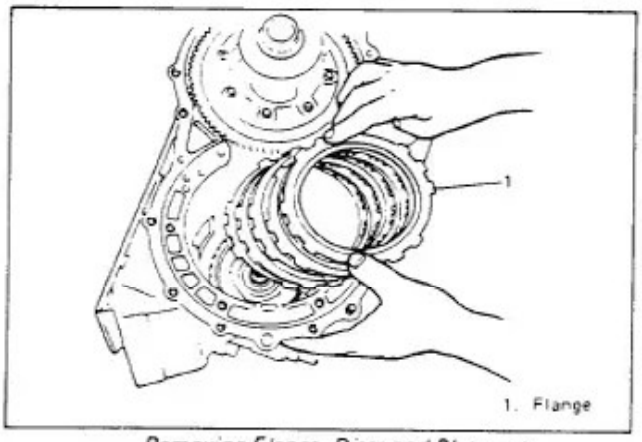
Checking 1st-reverse Brake Clearance

27. 2 snap rings by using a minus screwdriver.



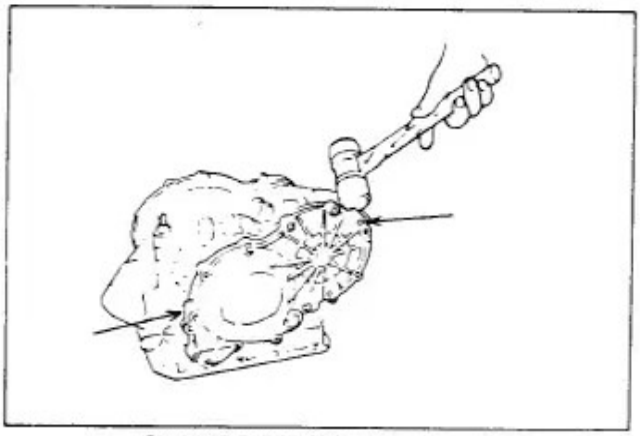
Removing 2 Snap Rings

28. 1st-reverse brake flange, discs, plates and damper plate.



Removing Flange, Discs and Plates, etc.

29. Differential gear ass'y.
30. Transaxle rear cover.
    1) Remove 10 bolts and 2 nuts.
    2) Remove rear cover by tapping lightly with a plastic hammer.

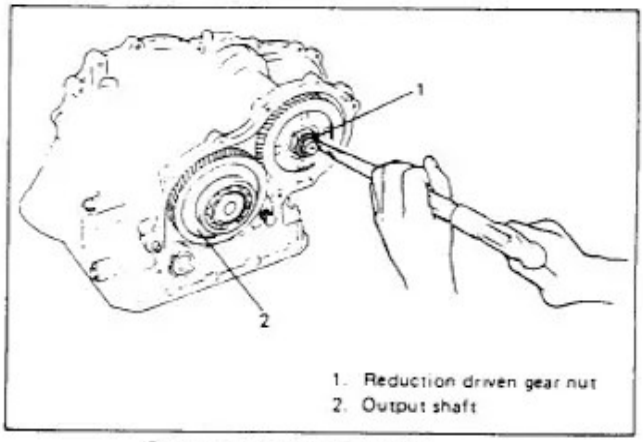


Removing Rear Cover

31. Reduction driven gear nut
    1) Free the nut from caulking by using a chisel.
    2) Shift manual shift lever to parking position ("P" range) so that output shaft is locked and cannot turn.
    3) Loosen the reduction driven gear nut.

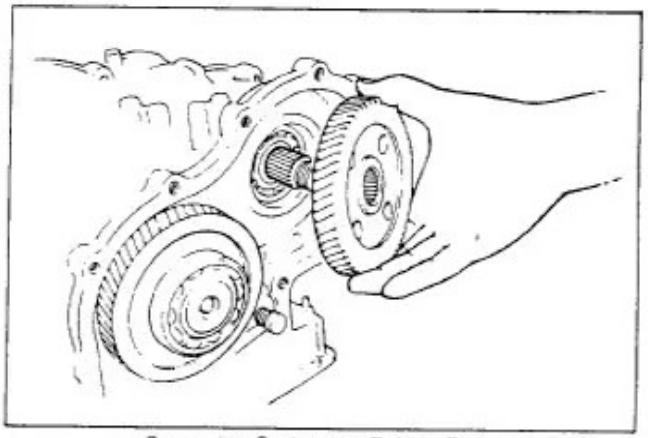
NOTICE:

Loosen the nut carefully by using a wrench. Do not cause a shock such as by hammering wrench as parking lock pawl and output shaft will be damaged.



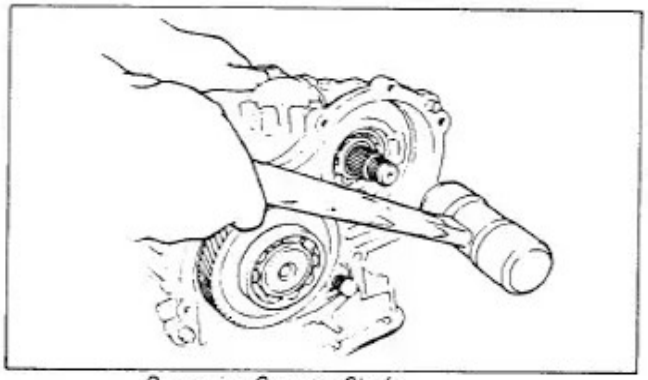
Reduction Driven Gear nut

32. Pull out reduction driven gear.



Removing Reduction Driven Gear

33. Drive counter shaft out with a plastic hammer.



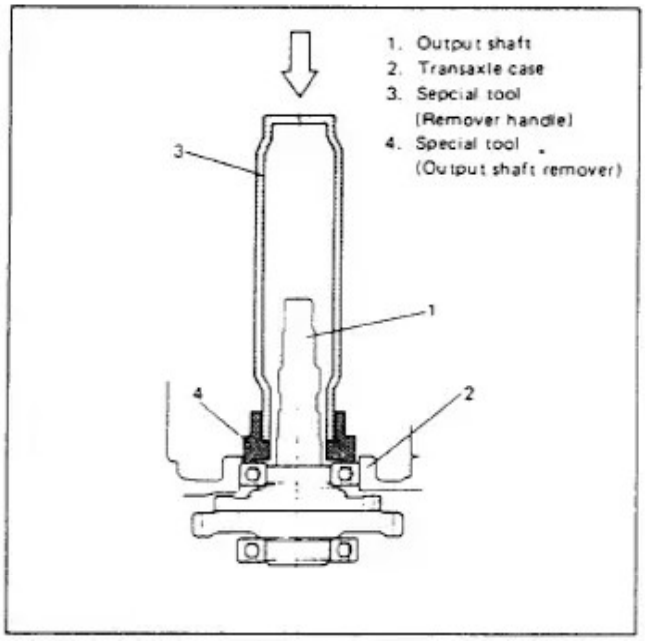
Removing Counter Shaft

34. Output shaft

Remove output shaft by pushing outer race of internal output shaft bearing with special tools (Output shaft remover 09927-08210, and remover handle 09925-18010) from inside of transaxle case.

NOTICE:

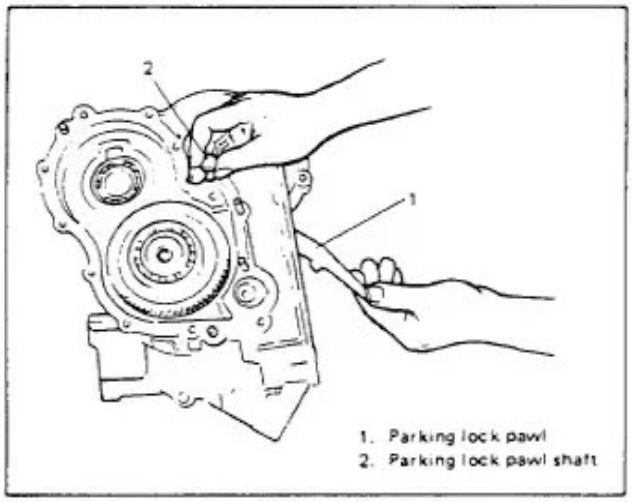
- **Do not tap output shaft itself to drive it out. Output shaft and bearing will be damaged.**
- **Be sure to fit 4 legs of special tool (Output shaft remover) in 4 notches of transaxle case.**



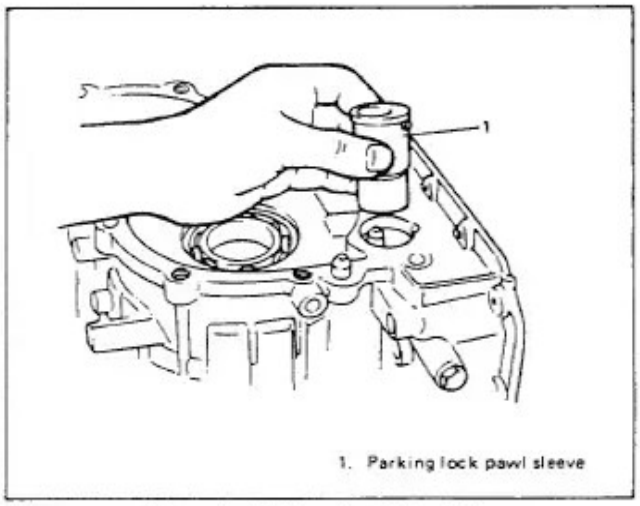
Removing Output Shaft

35. Parking lock pawl, pawl shaft and sleeve, etc.

1) Pull out parking lock pawl shaft and spring.
2) Remove parking lock pawl.
3) Pull out parking lock pawl sleeve.
4) Manual detent spring ass'y and manual shift shaft.



Removing Parking Lock Pawl Shaft & Parking Lock Pawl



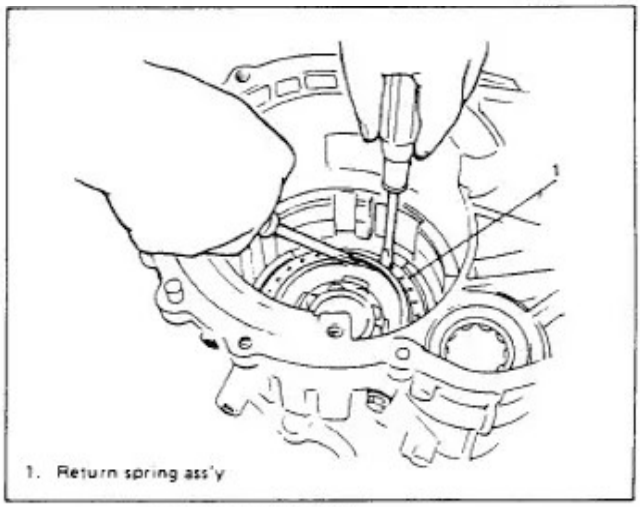
Removing Parking Lock Pawl Sleeve

36. 1st-reverse brake piston.

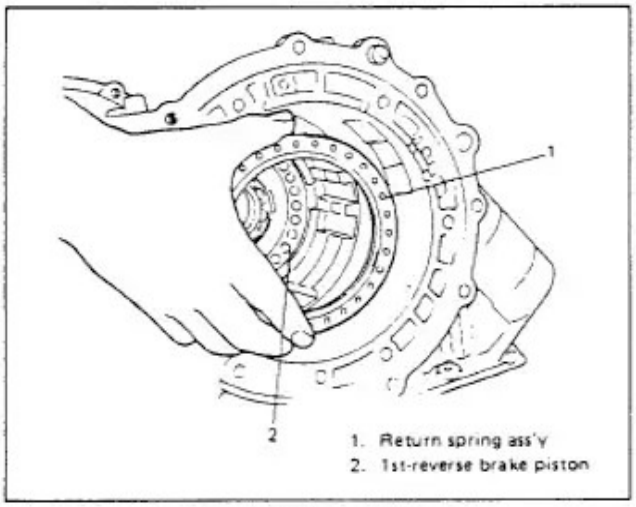
1) Push down return spring ass'y and remove snap ring.
2) Remove return spring ass'y.
3) Pull out 1st-reverse brake piston by blowing low-pressure air into oil hole

NOTICE:

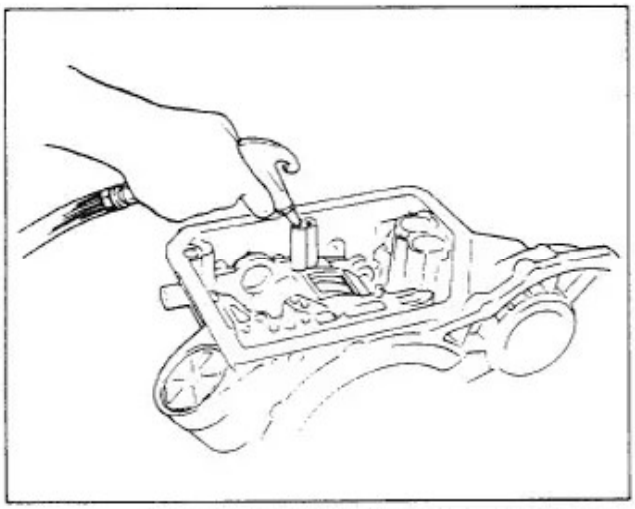
Blow air lightly so as not to tilt piston. If piston does not pop out with compressed air, lift out piston from case, using a needle nose pliers.



Removing Snap Ring

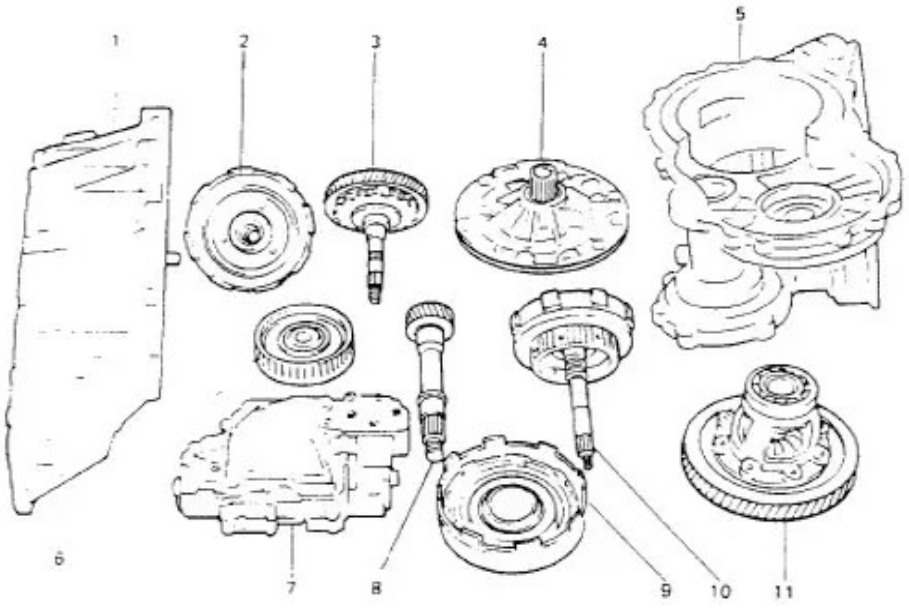


Removing return Spring Ass'y



Removing 1st-reverse Brake Piston by Blowing Air

COMPONENT GROUP OVERHAUL



1. Transaxle case housing
2. Sun gear & sun gear input drum
3. Output shaft
4. Oil pump
5. Transaxle case
6. Front planetary ring gear
7. Upper & lower valve bodies
8. Counter shaft
9. Direct clutch
10. Input shaft
11. Differential

Component Groups

General Description

This section describes disassembly, assembly, check and adjustment procedures of each component group.
(Refer to above figure)

Disassembly Notice

Note that parts of the same types are used among some component groups. For example, discs, clutch plates and seals used for different component groups are of the same shapes. If more than two component groups are disassembled at the same time, it may occur that these parts of the same shape but for different component groups are mixed and wrong parts are used for reassembly. Therefore, if it becomes necessary to overhaul more than two component groups, work on one component group at a time so as to prevent such erroneous installation. Should it be necessary to overhaul more than two groups at the same time for some reason, make sure to keep parts for each component group separately during disassembly so that they won't be mixed up.

Cleaning Notice

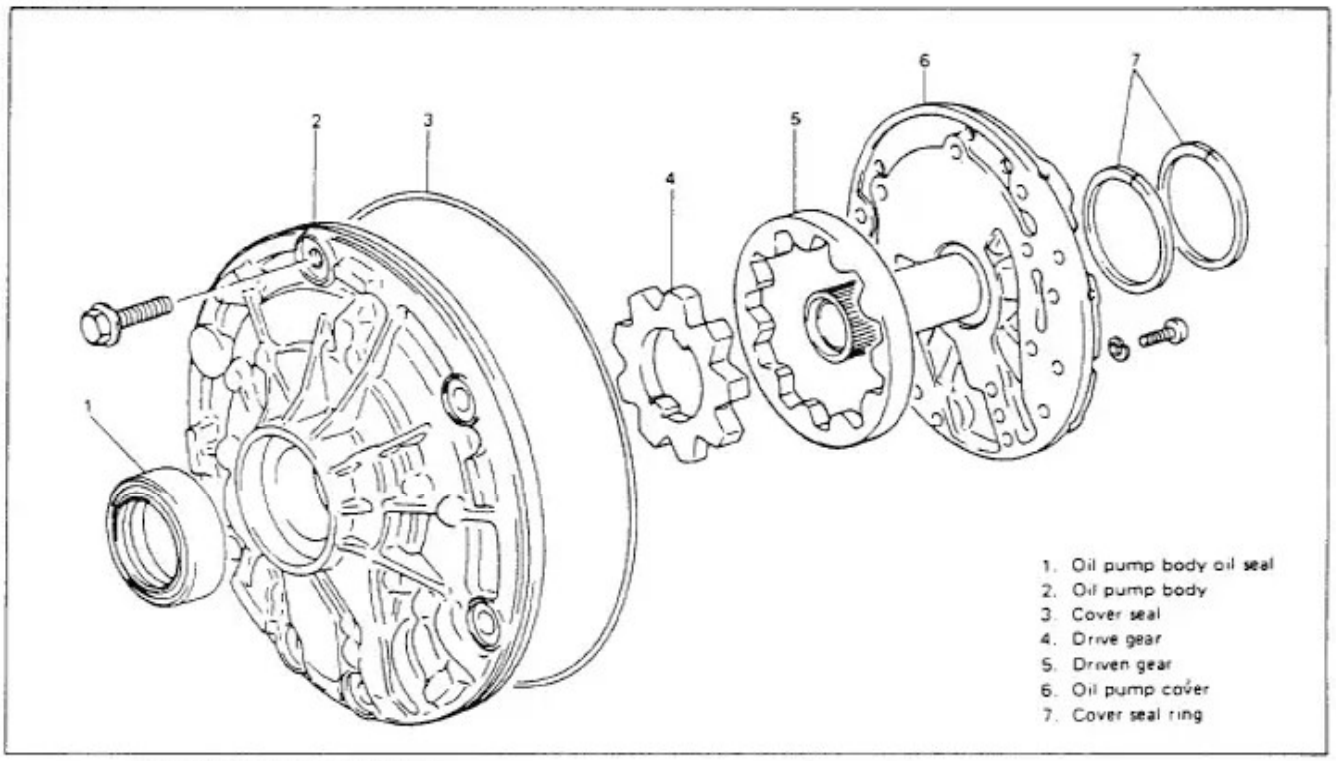
- Before reassembly, be sure to clean all disassembled parts and blow air into fluid passages and holes to clean them.
- Use automatic transaxle fluid or kerosene as cleaning solvent.
- When using compressed air to dry parts, keep your face away to avoid being sprayed with solvent.

Assembly Notice

- New brake discs, clutch discs and brake band that are to be used for replacement must be soaked in automatic transaxle fluid for at least 2 hours before assembly.
- Use special care when handling each part composed component group so as not to damage.
- Tighten each bolt and nut to their specified torque.
- Before installing, be sure to apply automatic transmission fluid (ATF) to sliding, rolling and thrusting surfaces of all component part. Also after installation, make sure to check each part for proper operation.
- After each gear installation, check to make sure that gear rotates smoothly.
- In handling bearing, use care not to damage it and apply ATF to it before installation.

- When installing snap ring, use care not to damage any other parts near snap ring.
- All gaskets and rubber "O" rings should be replaced.
- Make sure that snap ring ends are not aligned with one of cutouts and are installed in groove correctly.
- Check thrust bearings and races for wear or damage. Replace if necessary.
- While installing bearing, do not apply force to ball or roller. Install bearing by pressing carefully without applying impulsive force.
- Be sure to make proper selection of direct and forward clutch flanges, input shaft bearing race and 2nd brake rod and to adjust each to specification.
- When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.
- Apply ATF to "O" ring, too.
- As cloth chips may stick to parts, do not use gloves made of cloth for installation. Do not use waste cloth, either.
- Apply ATF immediately before installation, for dust and dirt are easy to stick to ATF applied on part.

OIL PUMP



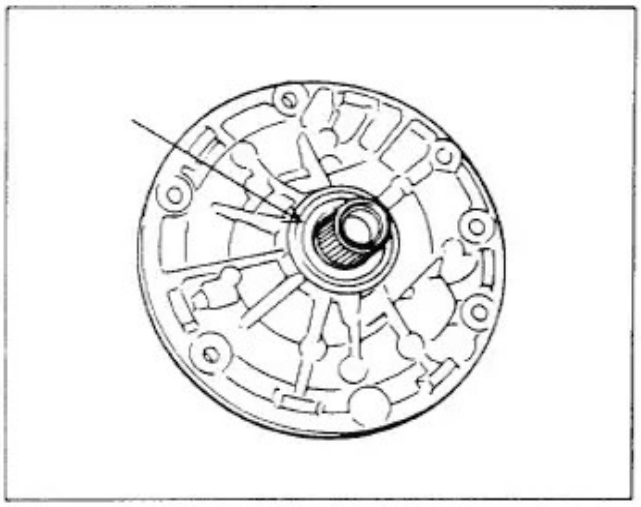
Exploded View of Oil Pump

Remove or Disconnect

1. 2 oil pump cover seal rings.
2. Oil pump cover seal ("O" ring).
3. 11 bolts.
4. Oil pump cover.

Inspect

1. Pump body oil seal.
   Check for wear, damage or cracks.
   Replace oil seal if necessary.

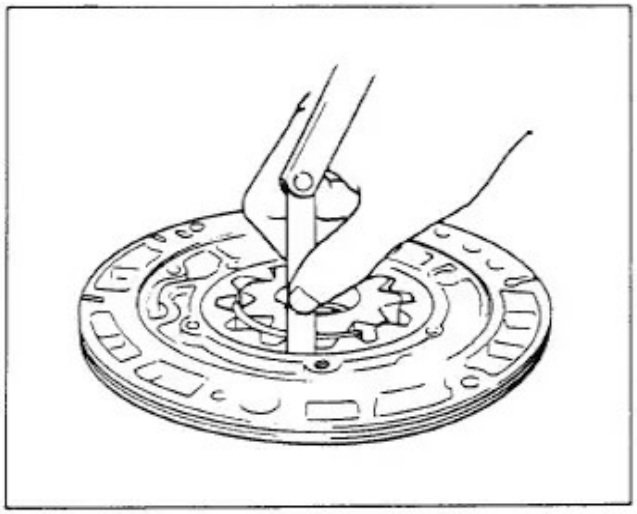


Pump Body Oil Seal

2. Body clearance of driven gear.
   Push driven gear to one side of body. Using a feeler gauge, measure clearance between driven gear and body.

Standard body clearance	0.07 – 0.15 mm (0.0028 – 0.0059 in)
Limit	0.30 mm (0.011 in)

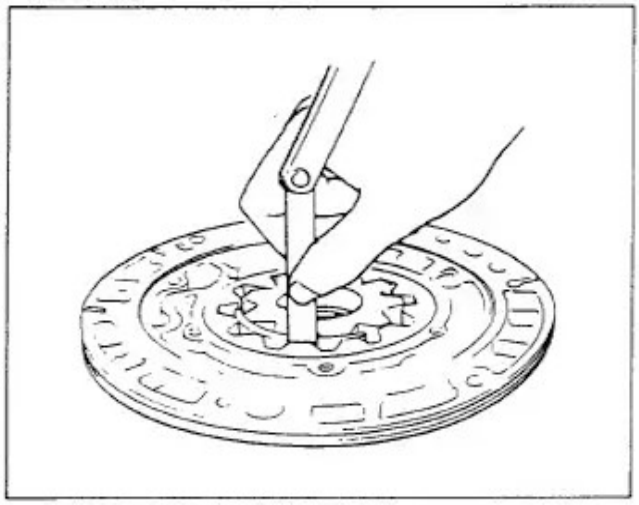
If the clearance exceeds the limit, replace driven gear.



Checking Body Clearance

3. Tip clearance of both drive and driven gears. Measure (radial) clearance between gear teeth and crescent.
   If the clearance exceeds the limit, replace the gear.

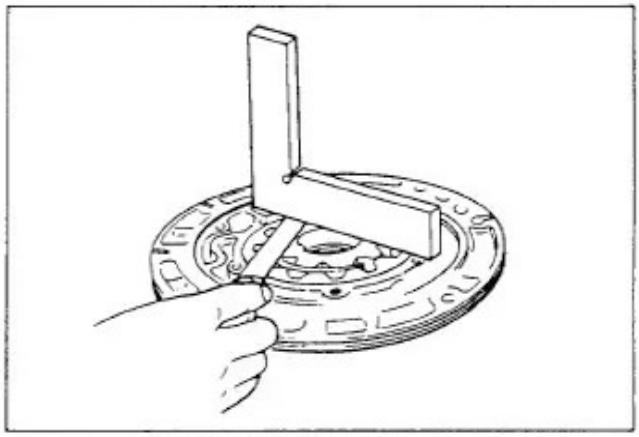
Standard tip clearance	0.11 – 0.14 mm (0.0043 – 0.0055 in)
Limit	0.30 mm (0.011 in)



Checking Tip Clearance

4. Side clearance of both gears.
   Using a steel straightedge and a feeler gauge, measure the side clearance between drive/driven gear and pump body.

Standard side clearance	0.02 – 0.05 mm (0.0008 – 0.0019 in)
Limit	0.1 mm (0.0039 in)

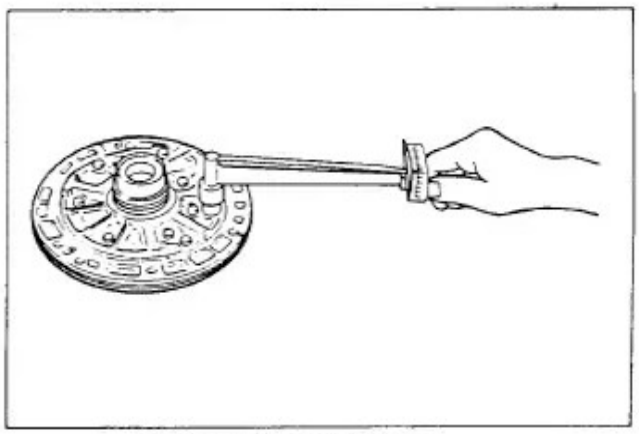


Checking Side Clearance

Install or Connect

1. Driven gear and drive gear to pump body after applying ATF to gears.
2. Pump cover to pump body and tighten 11 pump cover bolts to the specification.

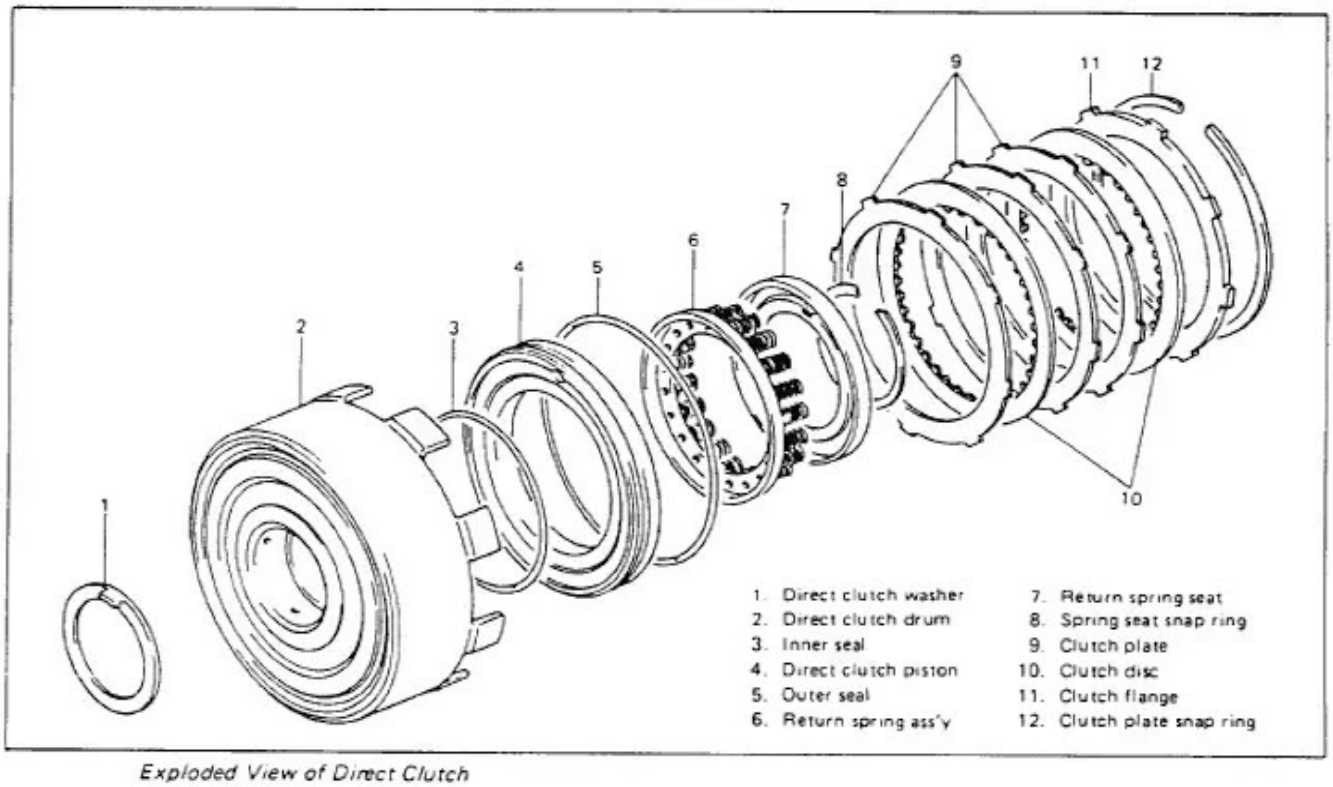
Pump cover bolt tightening torque	8 – 12 N·m 0.8 – 1.2 kg-m 6.0 – 8.5 lb-ft



Tightening Pump Cover Bolts

3. Two (2) oil pump cover seal rings.
4. Apply ATF to oil pump bushing and two (2) seal rings.
5. Oil pump cover seal (O ring)
   Make sure that seal is not twisted and is fully seated in groove.
6. Check drive gear for smooth rotation.

DIRECT CLUTCH



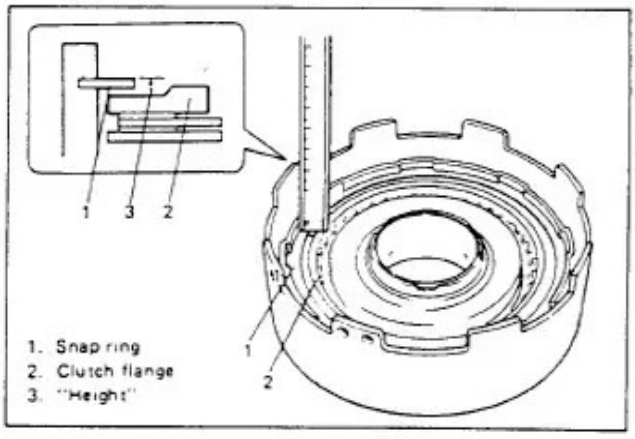
Exploded View of Direct Clutch

Preliminary Check

Check direct clutch clearance before disassembly.

For checking the clearance, measure the height between snap ring and clutch flange by using vernier as shown in figure. If the height is within specification, it means that the clutch clearance is within specification. If the height is out of specification, replace clutch discs or plates with new ones.

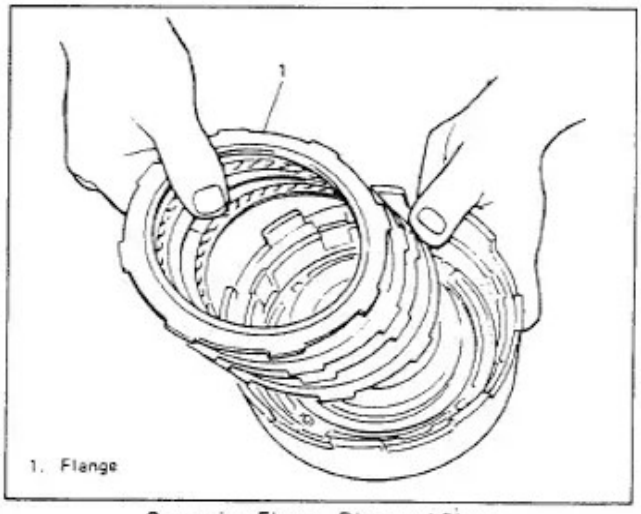
Height between snap ring and clutch flange	2.49 – 3.06 mm (0.098 – 0.120 in)



Checking Direct Clutch Clearance

Remove or Disconnect

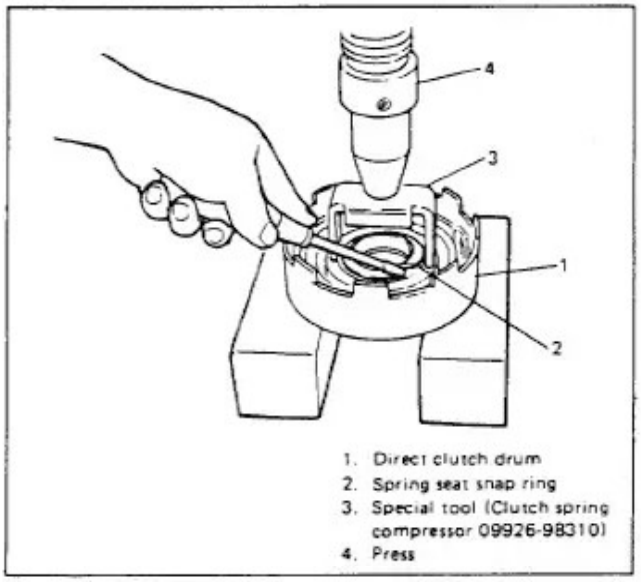
1. Clutch plate snap ring.
2. Clutch flange, discs and plates.



Removing Flange, Discs and Plates

3. Spring seat snap ring.
   Compress piston return springs and remove snap ring. Place special tool (clutch spring compressor) on return spring seat and compress springs with a press. Then using a screwdriver, remove snap ring.

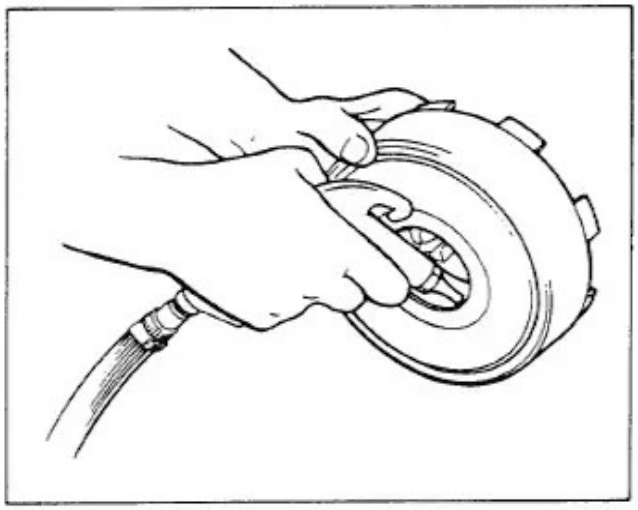
NOTICE:
If piston return springs are compressed as far down as to allow snap ring to move, it is enough. If compressed farther down, spring seat may get deformed.



1. Direct clutch drum
2. Spring seat snap ring
3. Special tool (Clutch spring compressor 09926-98310)
4. Press

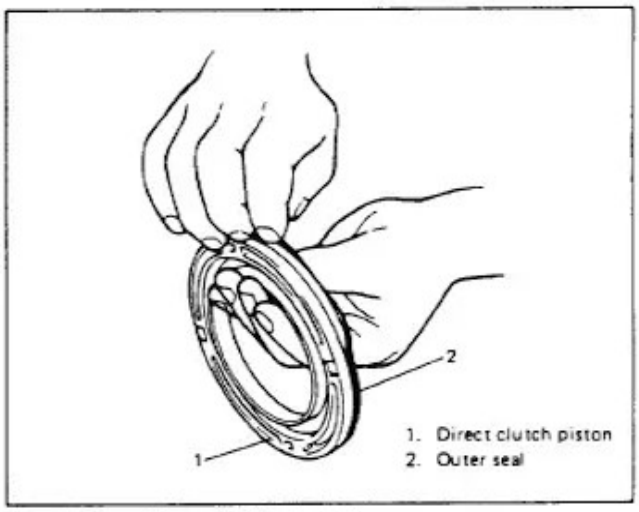
Removing Snap Ring

4. Spring seat and return spring ass'y
5. Direct clutch piston
   Blow compressed air through drum oil hole to remove piston. If piston does not pop out, lift out the piston with needle nose pliers.



Removing Direct Clutch Piston by Blowing Air

6. Inner seal from drum.
7. Outer seal from piston.

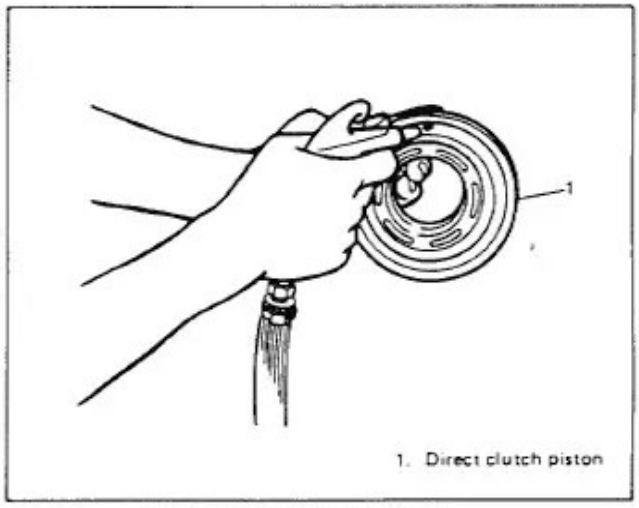


1. Direct clutch piston
2. Outer seal

Removing Outer Seal

Inspect

1. Check valve (steel ball) for free movement in piston.
2. Check valve for leakage by using low pressure air.
   If found faulty, replace the piston.

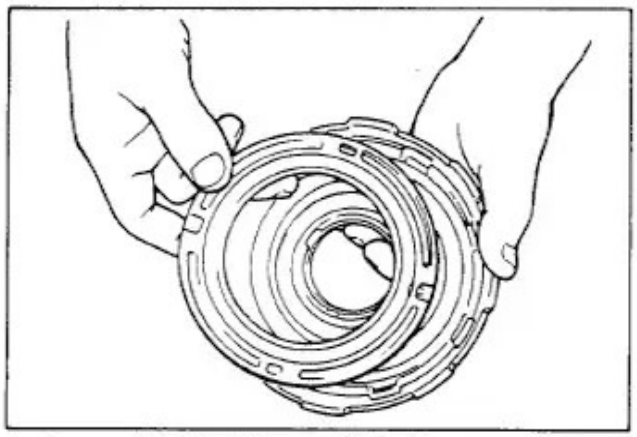


1. Direct clutch piston

Checking Check Ball Leakage

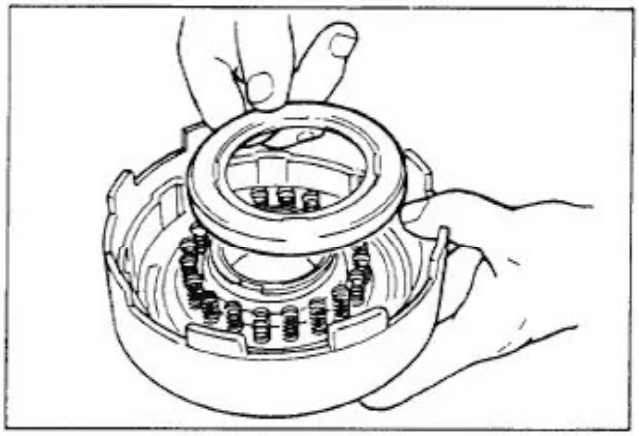
Install or Connect

1. Inner seal ("O" ring).
   Apply ATF to inner seal and fit it in drum. Use new inner seal.
2. Outer seal ("O" ring).
   Apply ATF to outer seal and fit it to piston. Use new outer seal.
3. Piston into drum.
   Be careful so that seals ("O" ring) does not get twisted or caught.



Installing Piston to Drum

4. Clutch return spring ass'y.
5. Spring seat.



Installing Spring Seat

6. Snap ring.
   Compress return springs and install spring seat snap ring in groove. Place special tool (clutch spring compressor) on spring seat and compress springs with press, and then, install snap ring using a screwdriver.
   for usage of special tool (Clutch spring compressor).

NOTICE:

- **Check to make sure that snap ring is securely fitted in 4 projections of spring seat.**
- **Do not compress return spring more than necessary.**

7. Discs, plates and flange.
   Install the following in that order.

   ① Plate ② Clutch disc ③ Plate
   ④ Plate ⑤ Clutch disc ⑥ Flange

NOTICE:

If new clutch discs are to be installed, they must be soaked in automatic transmission fluid for at least 2 hours before assembly.

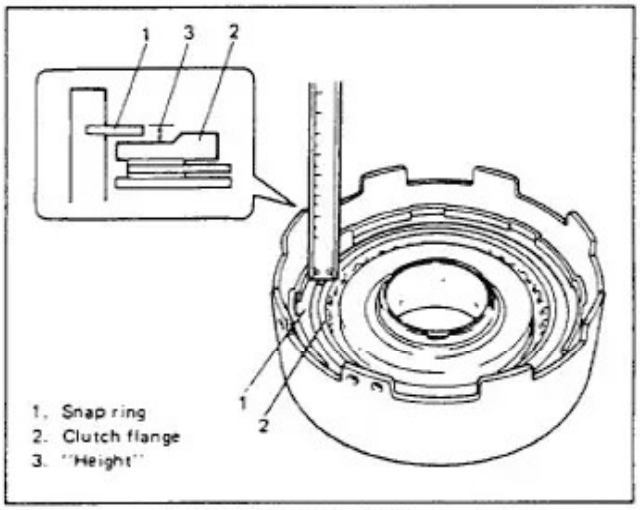
8. Clutch plate snap ring.

9. After installing clutch plate snap ring, measure the height between snap ring and clutch flange as previously outlined.

Height	2.49 – 3.06 mm (0.098 – 0.120 in)

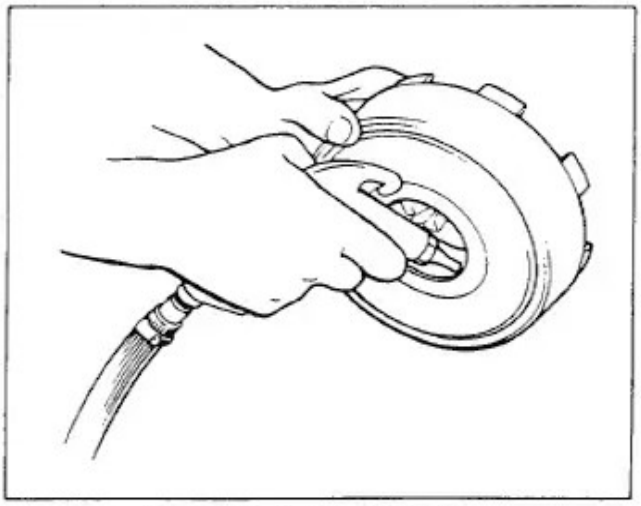
If out of specification even when new clutch discs and plates are installed, install flange of different thickness. Following 2 types of clutch flanges are available as spare parts.

	Thickness
Available clutch flange	3.00 mm (0.118 in)
	3.37 mm (0.132 in)



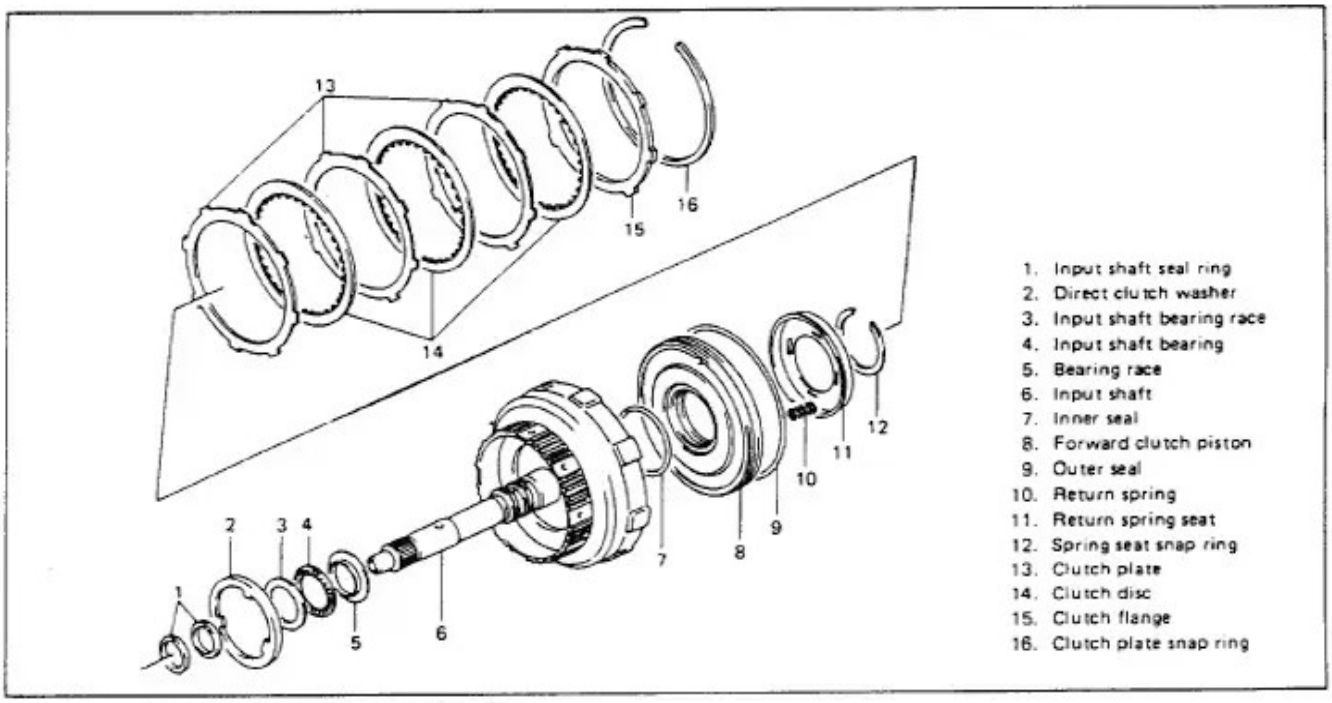
Checking Direct Clutch Clearance

10. Check piston for movement by blowing air through oil hole in drum.



Checking Piston for Movement

FORWARD CLUTCH



Exploded View of Forward Clutch

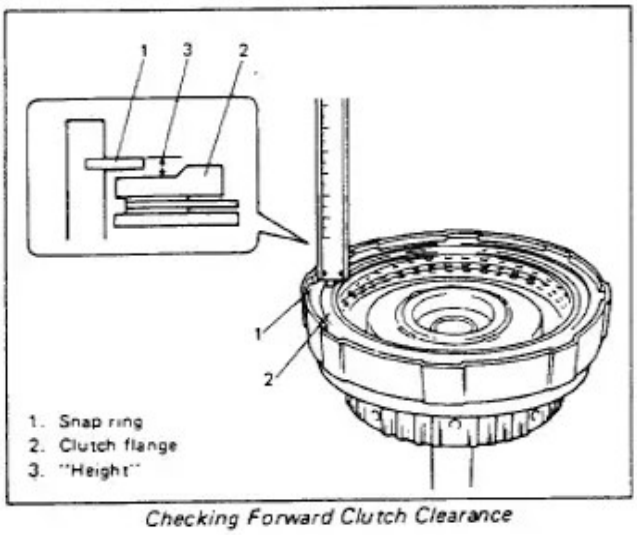
Preliminary Check

Check forward clutch clearance before disassembly.

For checking the clearance, measure the height between snap ring and clutch flange by using vernier as shown in figure. If the height is within specification, it means that the clutch clearance is within specification.

If the height is out of specification, replace clutch discs or plates with new ones.

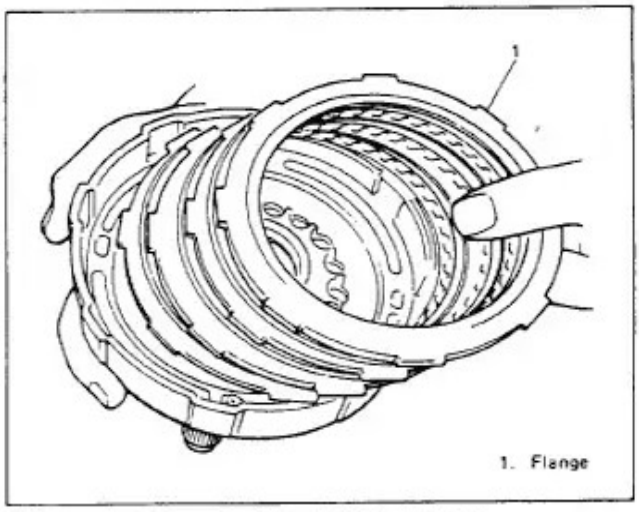
Height between snap ring and clutch flange	2.01 – 2.68 mm (0.079 – 0.105 in)



Checking Forward Clutch Clearance

Remove or Disconnect

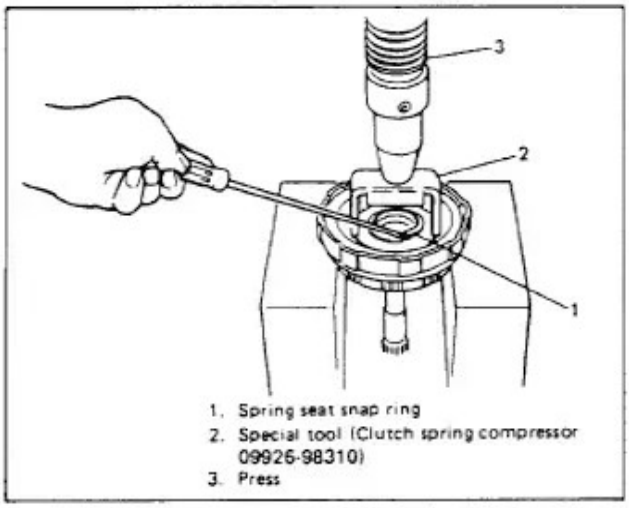
1. Clutch plate snap ring.
2. Flange, discs and plates.



Removing Flange, Discs & Plates

3. Spring seat snap ring.
   Compress piston return springs and remove snap ring. Place special tool (clutch spring compressor) on spring seat and compress spring with a press, and then, remove snap ring, using a screwdriver.

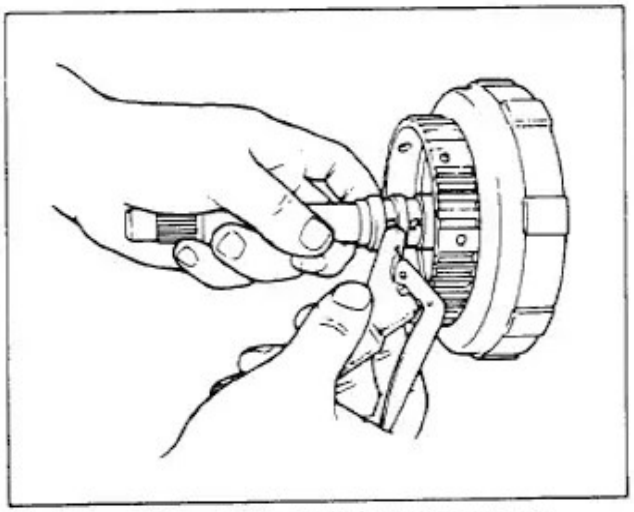
NOTICE:
Do not push down return spring more than necessary.



1. Spring seat snap ring
2. Special tool (Clutch spring compressor 09926-98310)
3. Press

Removing Spring Seat Snap Ring

4. Spring seat and springs.
5. Forward clutch piston.
   Blow compressed air through input shaft oil hole to remove piston. If piston does not pop out, lift it out with needle nose pliers.



Removing Clutch Piston by Blowing Air

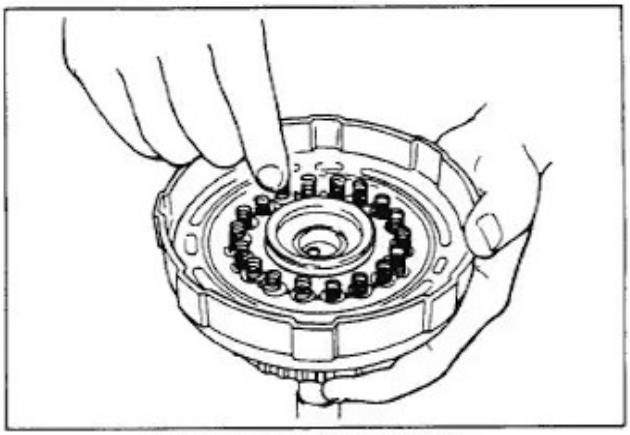
6. Inner and outer seals ("O" rings) from piston.

Inspect

1. Check valve (ball) for free movement in clutch piston.
2. Check valve for leakage by using low pressure air. If found faulty; replace clutch piston.

Install or Connect

1. Inner and outer seals ("O" rings) to clutch piston.
   Apply ATF to them and fit to piston. Use new seals.
2. Piston into input shaft drum.
   Use care so that seals do not get twisted or caught.
3. 18 piston return springs and spring seat.



Installing Piston Return Springs

4. Spring seat snap ring.
   Compress return springs and install snap ring in groove by using a screwdriver.
   Place special tool (clutch spring compressor) on spring seat and compress springs with a press. See figure (left above) for usage of special tool (clutch spring compressor).

NOTICE:
- **Check to make sure that snap ring is securely fitted in 4 projections of spring seat.**
- **Do not compress return spring more than necessary.**

5. Install discs, plates and flange.
   Install them in following order.

   ① Plate ② Clutch disc ③ Plate
   ④ Clutch disc ⑤ Plate ⑥ Clutch disc ⑦ Flange

6. Clutch plate snap ring.
7. After installing clutch plate snap ring, measure the height between snap ring and clutch flange as previously outlined.

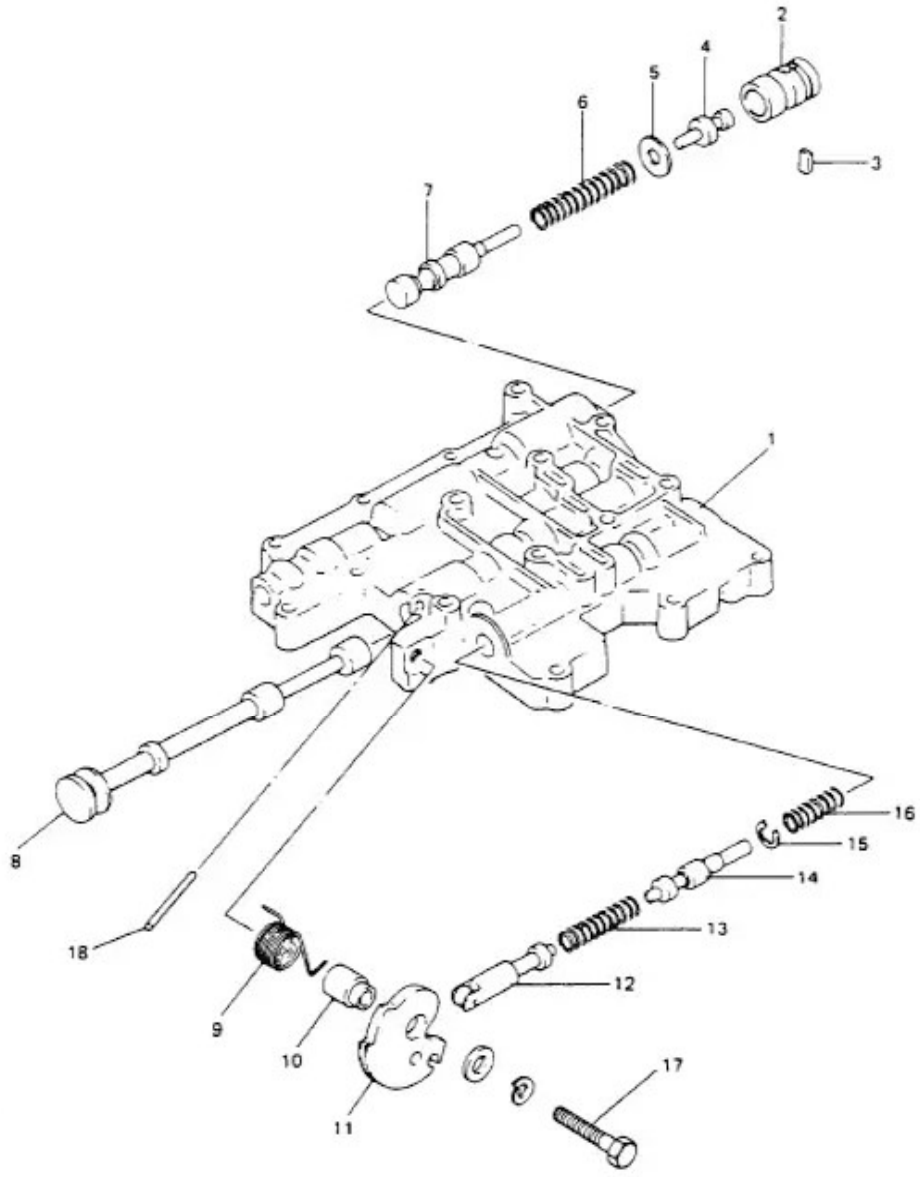
Height	2.01 – 2.68 mm (0.079 – 0.105 in)

If discs and plates are new and yet out of above specification, install flange of different thickness. Following 2 types of clutch flanges are available as spare parts.

	Thickness
Available clutch flange	3.00 mm (0.118 in)
	3.37 mm (0.132 in)

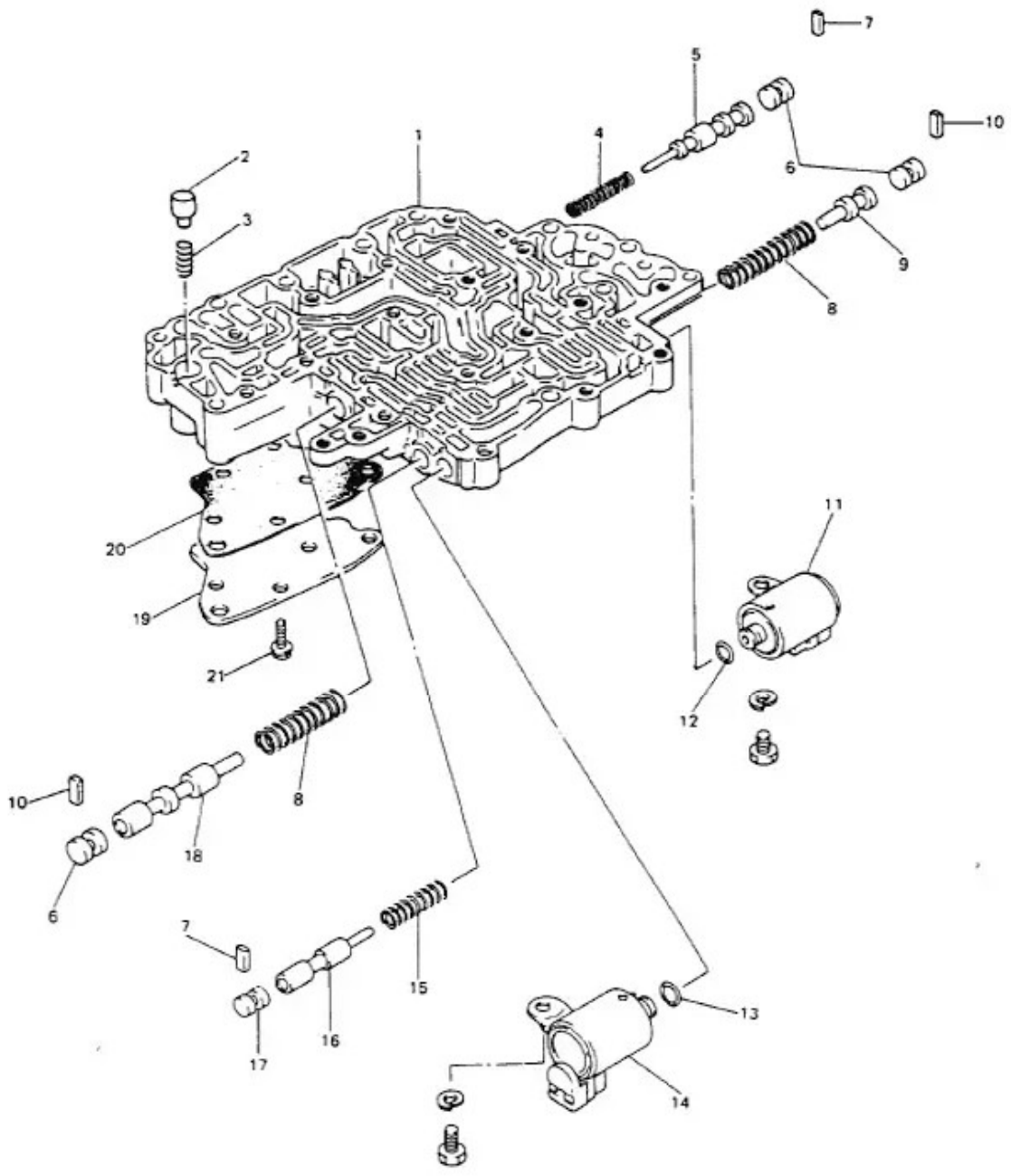
8. Check clutch piston for movement by blowing air through input shaft oil hole.

UPPER AND LOWER VALVE BODIES



1. Upper valve body
2. Pressure regulator valve sleeve
3. No. 1 key
4. Primary regulator valve plunger
5. Plate washer
6. Primary regulator valve spring (Red. Length: 52.5 mm)
7. Primary regulator valve
8. Manual valve
9. Throttle valve spring
10. Throttle valve cam pin
11. Throttle valve cam
12. Down shift plug
13. Throttle valve No. 2 spring (Blue. Length: 31.04 mm)
14. Throttle valve
15. Throttle valve ring(s)
16. Throttle valve No. 1 spring (White. Length: 22.2 mm)
17. Throttle valve cam bolt
18. Neutral drain nozzle

Upper Valve Body Components

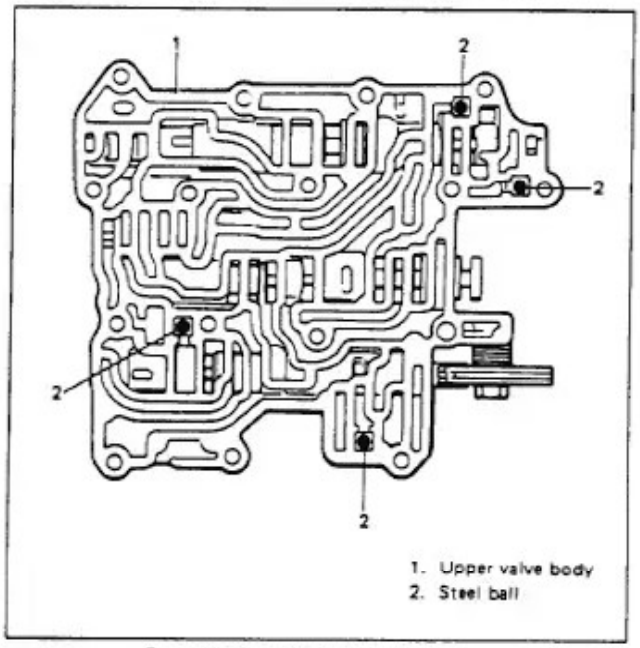


1. Lower valve body
2. Cooler by-pass valve
3. Spring (Orange. Length: 19.9 mm)
4. Secondary regulator valve spring (Brown. Length: 30.17 mm)
5. Secondary regulator valve
6. Plug
7. No. 1 key
8. Shift valve spring (Pink. Length: 39.6 mm)
9. 2 – 3 shift valve
10. No. 2 key
11. Direct clutch solenoid
12. Seal
13. Seal
14. 2nd brake solenoid
15. B_2 control valve spring (Blue. Length: 28.1 mm)
16. B_2 control valve
17. B_2 control valve plug
18. 1 – 2 shift valve
19. Lower valve body cover
20. Gasket
21. Lower valve body cover bolt

Lower Valve Body Components

Important Steps in Disassembly and Reassembly of Valve Bodies

- When disassembling valve body, be sure to keep each valve together with its corresponding spring.
- When removing upper valve body from lower one, be careful not to fall out 4 pcs of steel ball shown in figure. When assembling, install these four (4) steel balls at the positions in upper valve body as shown in figure.



Four (4) Steel Balls Installation

- Replace each gasket with new one. Make sure that new gasket is the same as the old one before installation.
- When installing each valve to valve body, use special care for proper installing direction.
- Several of throttle valve rings are used at the throttle valve in upper valve body. Be sure to install the same number of throttle valve rings as those used before disassembly.
- When installing lower valve body cover and gasket to lower valve body, tighten the lower valve body bolts to specification.

Lower valve body cover bolts tightening torque	4 – 6 N·m 0.4 – 0.6 kg-m 3.0 – 4.0 lb-ft

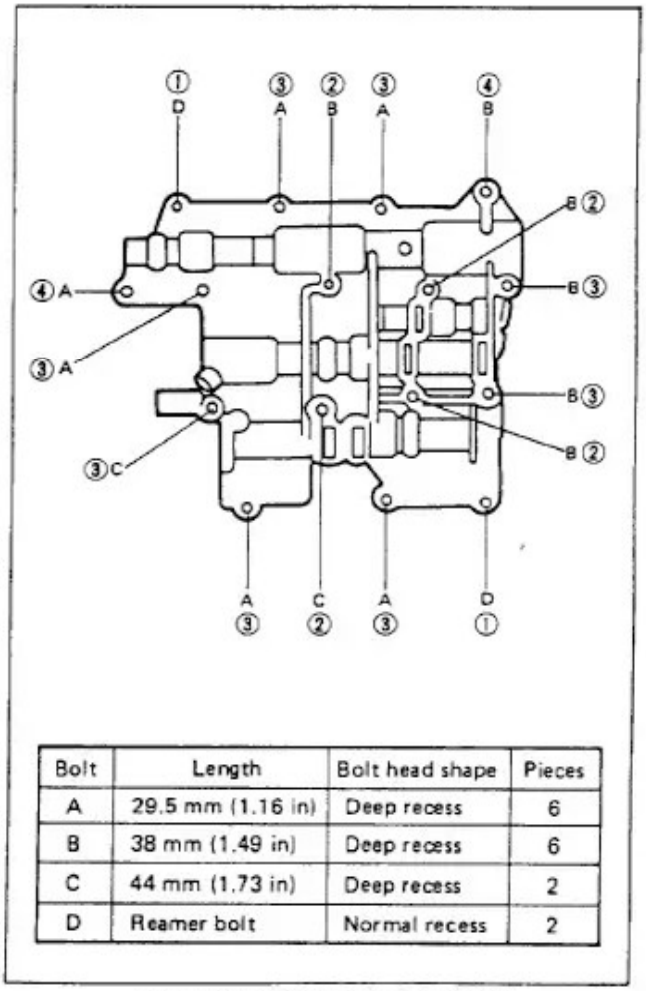
- Tighten throttle valve cam bolt to specification.

Throttle valve cam bolt tightening torque	6 – 9 N·m 0.6 – 0.9 kg-m 4.5 – 6.5 lb-ft

- When installing upper valve body to lower one, install sixteen (16) upper valve body bolts as follows.

Upper valve body bolts tightening torque	5 – 6 N·m 0.5 – 0.6 kg-m 3.7 – 4.3 lb-ft

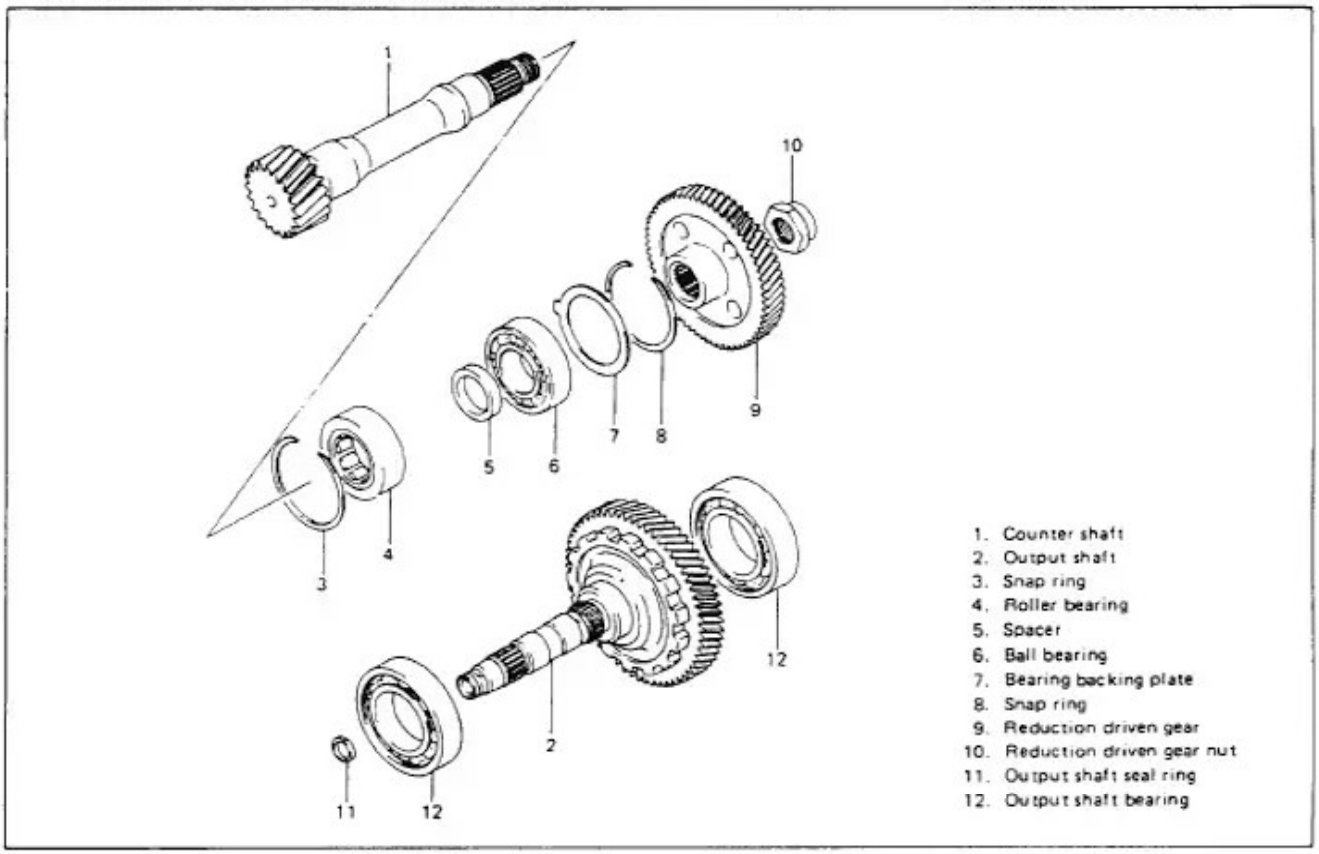
1) Install two (2) reamer bolts (positioning bolts) at the positions shown as "D" in below figure. Do not tighten these bolts to specification at this time. Finger-tight only.
2) Install other 14 bolts as shown in figure.
3) Tighten four (4) bolts ② to specification.
4) Tighten eight (8) bolts ③ to specification.
5) Tighten two (2) bolts ④ and two reamer bolts ① to specification.



Bolt	Length	Bolt head shape	Pieces
A	29.5 mm (1.16 in)	Deep recess	6
B	38 mm (1.49 in)	Deep recess	6
C	44 mm (1.73 in)	Deep recess	2
D	Reamer bolt	Normal recess	2

Upper Valve Body Bolts Installation

COUNTER SHAFT AND OUTPUT SHAFT BEARINGS

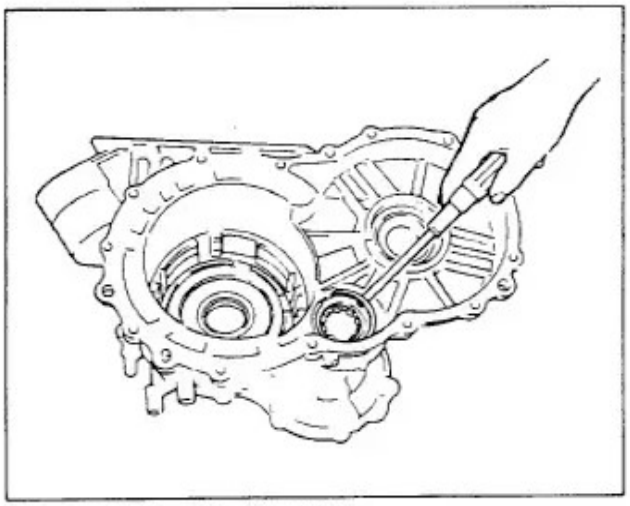


Counter Shaft and Output Shaft

Counter Shaft Bearings

Remove or disconnect

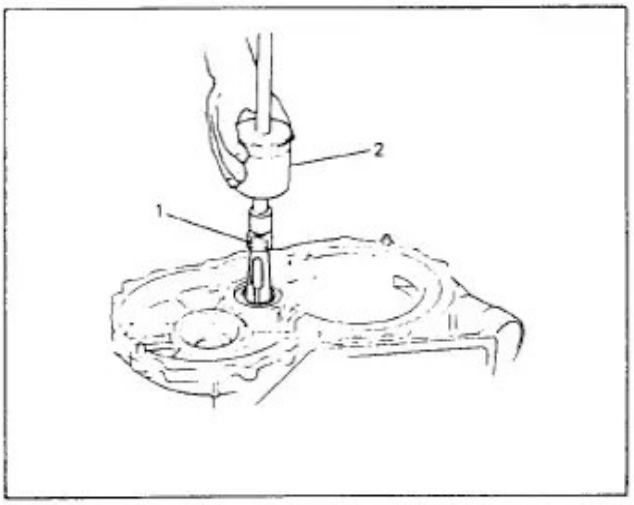
1. Snap rings by using a screwdriver.



Removing Snap Ring

2. Backing plate (rear cover side).
3. Front and rear counter shaft bearings.

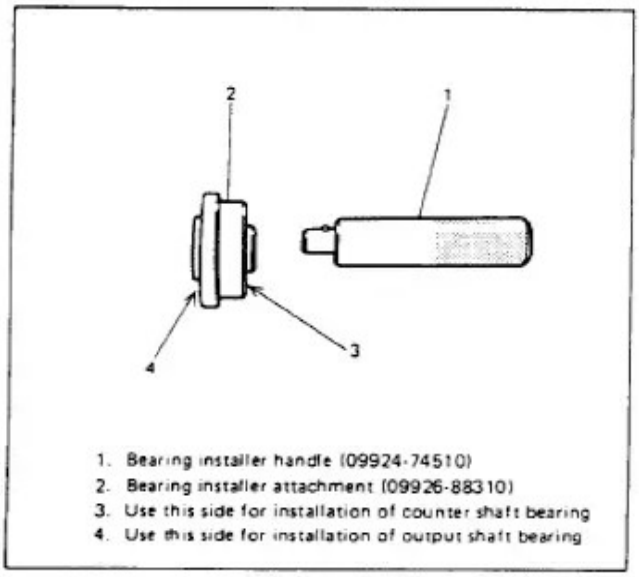
1) Using special tools (Bearing remover and sliding shaft), remove the bearing.
2) Remove other side of bearing with the same way.



Removing Bearing

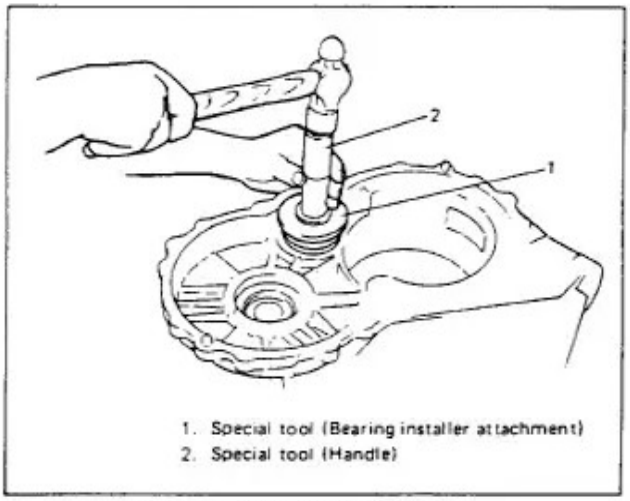
Install or connect

1. Counter shaft bearing (Roller bearing) to case.
   Use special tools (Bearing installer attachment and installer handle).
   The bearing installer attachment has two sides used for installation of counter shaft bearings and output shaft bearing. See below figure for details.



1. Bearing installer handle (09924-74510)
2. Bearing installer attachment (09926-88310)
3. Use this side for installation of counter shaft bearing
4. Use this side for installation of output shaft bearing

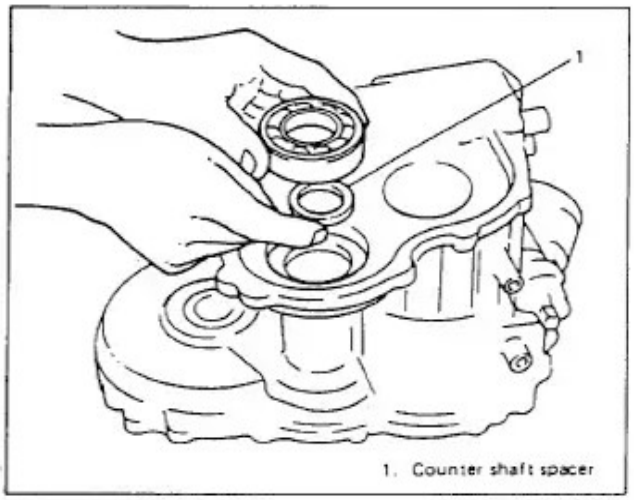
Special Tools (Bearing Installer Attachment and Handle)



1. Special tool (Bearing installer attachment)
2. Special tool (Handle)

Installing Counter Shaft Bearing

2. Snap ring.
3. Counter shaft spacer to case.
4. Another counter shaft bearing (ball bearing) to case. Use special tools (Bearing installer attachment and installer handle).



1. Counter shaft spacer

Installing Counter Shaft Spacer

5. Bearing backing plate and snap ring.

Output Shaft Bearings

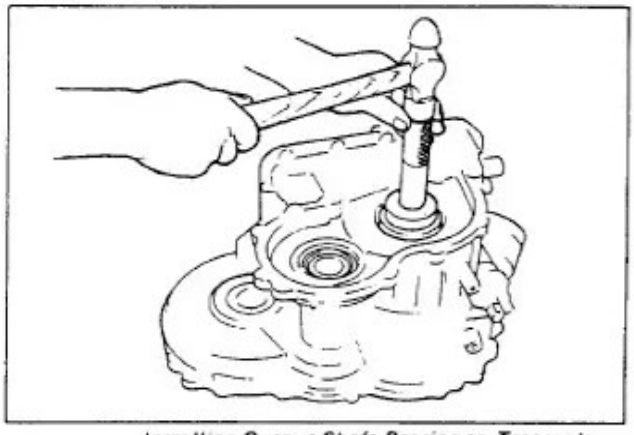
When replacing output shaft bearing, remove the damaged bearing and install new bearing as follows.

Remove or disconnect

- Output shaft bearing from output shaft by using two tire levers. Do not reuse the removed bearing.

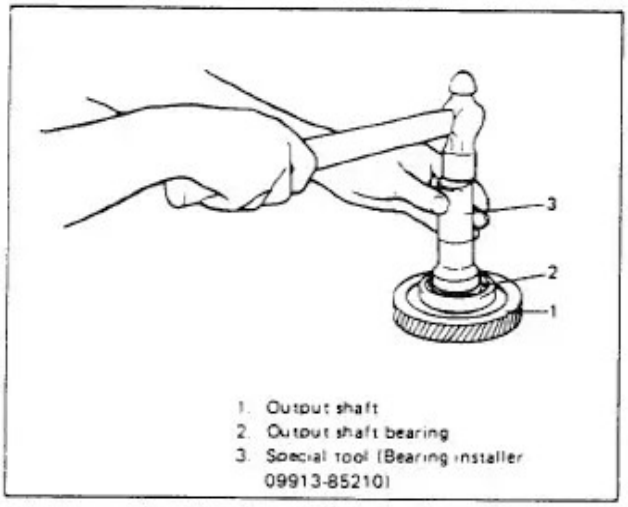
Install or connect

- New output shaft bearing to transaxle case. Use special tools (Bearing installer attachment and installer handle).



Installing Output Shaft Bearing to Transaxle Case

- New output shaft bearing to output shaft. Use special tool (Bearing installer).



1. Output shaft
2. Output shaft bearing
3. Special tool (Bearing installer 09913-85210)

Installing Output Shaft Bearing to Output Shaft

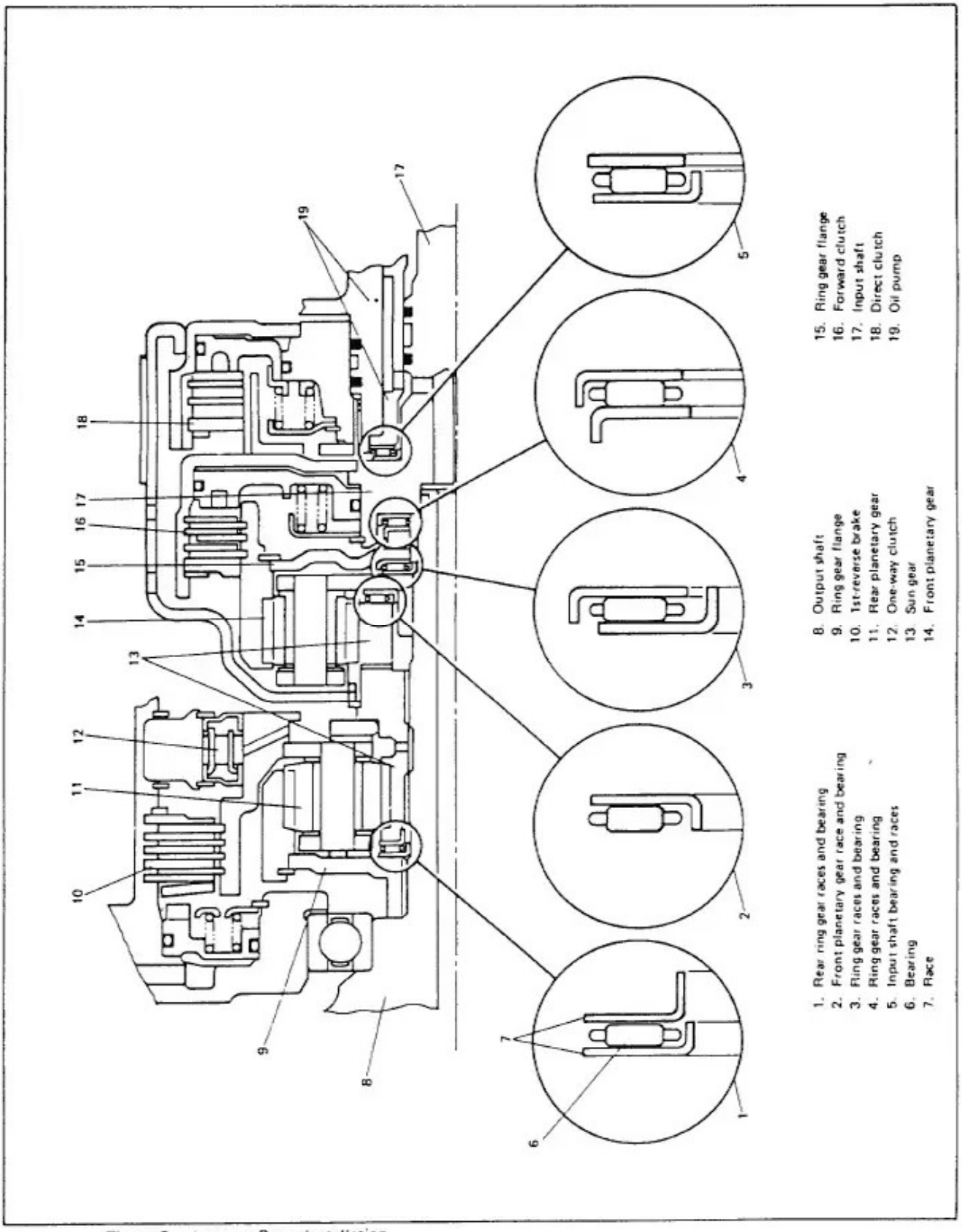
DIFFERENTIAL ASS'Y

Disassembly and assembly procedures for differential ass'y are the same as those for manual transaxle differential ass'y.

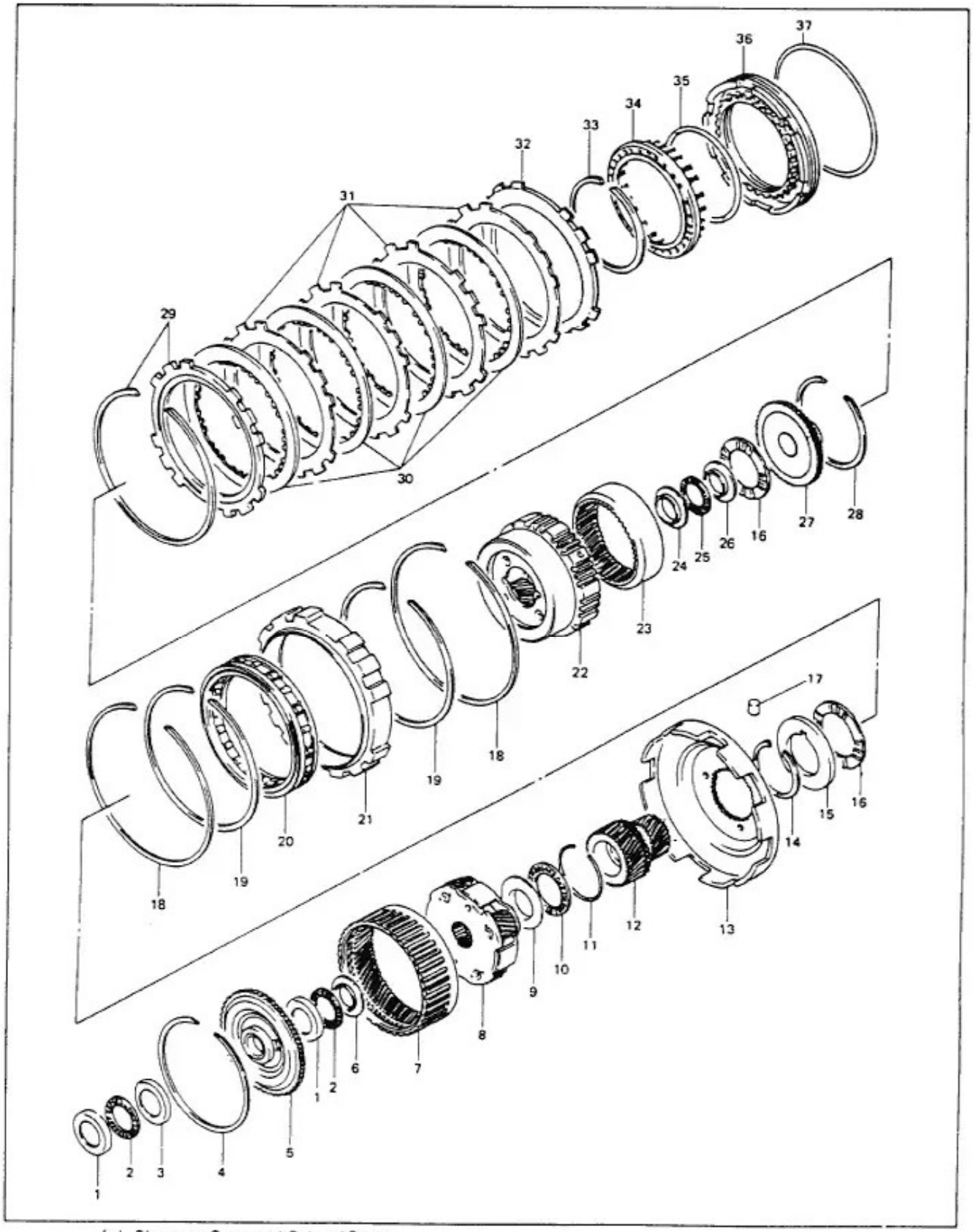
ASSEMBLY OF TRANSAXLE

GENERAL ASSEMBLY NOTICE

1. Automatic transaxle consists of highly precise parts. As even a flaw in a small part may cause oil leakage or decrease in function, check each part carefully before installation.
2. Be sure to torque each bolt and nut to specification.
3. Before assembling new clutch discs and brake band, soak them in automatic transmission fluid for at least 2 hours.
4. Apply automatic transmission fluid on sliding or rotating surfaces of the parts before assembly.
5. Do not use adhesive cements on gaskets and similar parts.
6. When assembling transaxle, be sure to use new gaskets and "O" rings.
7. Clean all parts by blowing with compressed air. To prevent cloth chips from sticking to parts, never use shop rags for cleaning.
8. Be sure to install thrust bearings and races in correct direction and position as shown in right figure.



Thrust Bearings and Races Installation



(a) Planetary Gears and Related Parts

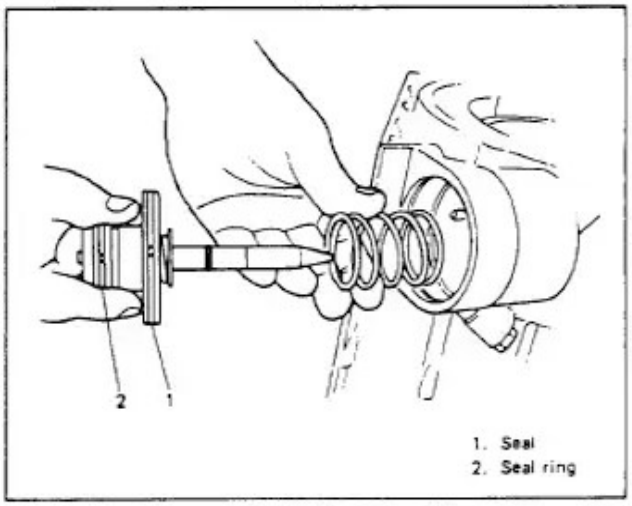
1. Ring gear race
2. Ring gear bearing
3. Ring gear race
4. Snap ring
5. Ring gear flange
6. Ring gear race
7. Front planetary ring gear
8. Front planetary gear ass'y
9. Front planetary gear race
10. Front planetary gear bearing
11. Input drum snap ring
12. Sun gear
13. Sun gear input drum
14. Snap ring
15. Planetary thrust washer
16. Rear planetary thrust washer
17. Sun gear pin
18. One-way clutch race snap ring
19. One-way clutch snap ring
20. One-way clutch
21. One-way clutch race
22. Rear planetary gear ass'y
23. Rear planetary ring gear
24. Rear ring gear race
25. Ring gear bearing
26. Rear ring gear race
27. Ring gear flange
28. Ring gear snap ring
29. 1st-reverse brake flange and snap ring
30. 1st-reverse brake disc
31. 1st-reverse brake plate
32. 1st-reverse brake damper plate
33. Return spring snap ring
34. 1st-reverse brake return spring
35. Piston inner seal
36. 1st-reverse brake piston
37. Piston outer seal

(b) Planetary Gears and Related Parts

Install or Connect

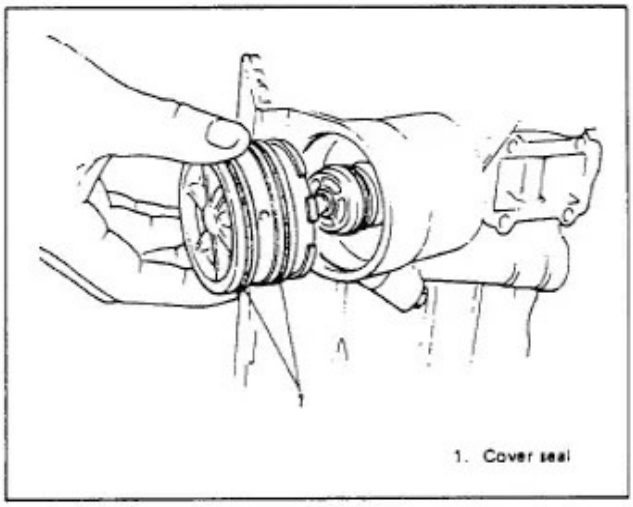
1. 2nd brake piston

1) Put piston spring in transaxle case and insert piston ass'y into case after applying ATF to piston rod, seal and seal ring.

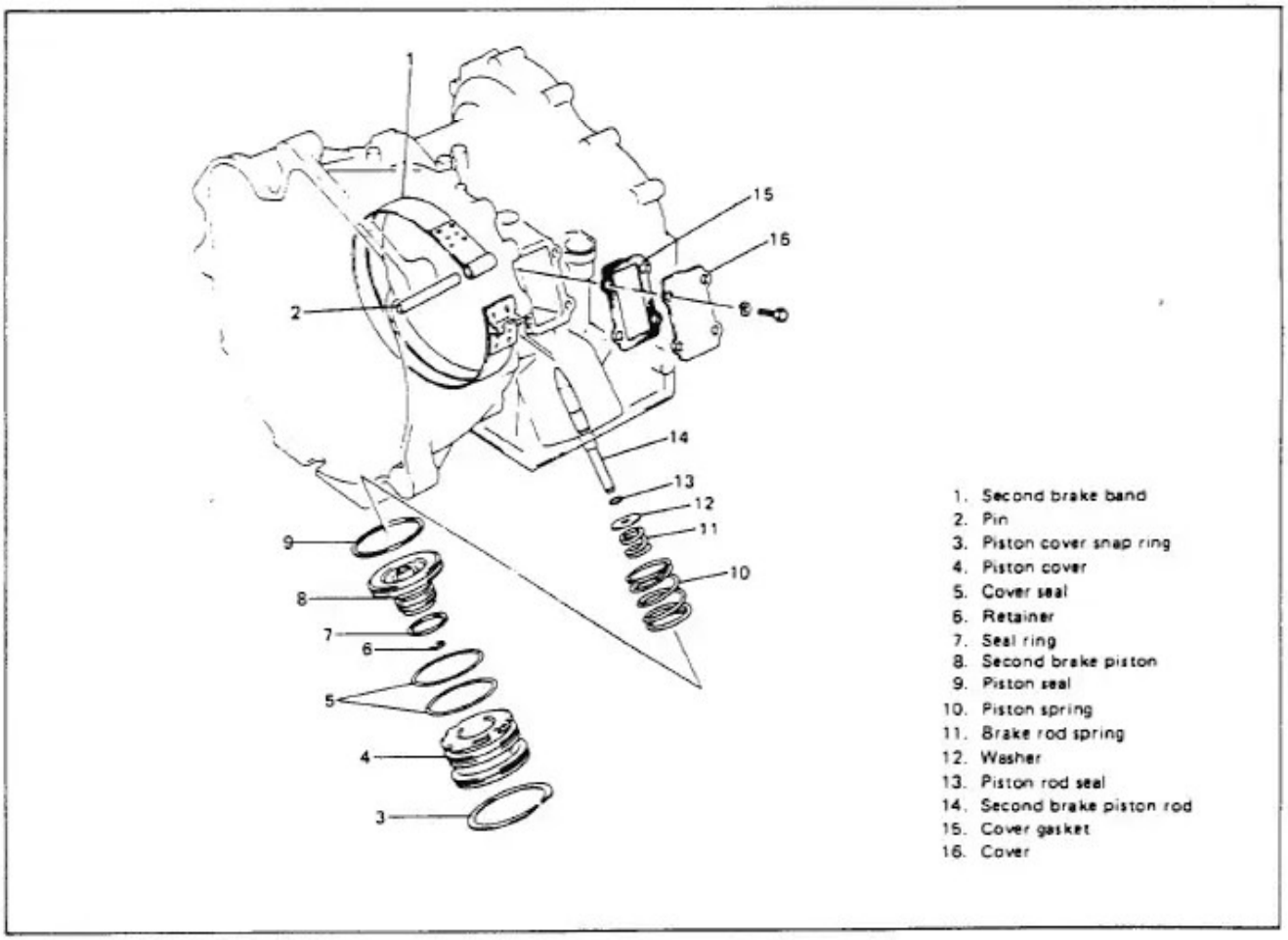


2nd Brake Piston Spring and Piston

2) Piston cover to case after applying ATF to 2 cover seals.
3) Push down piston cover and install snap ring.

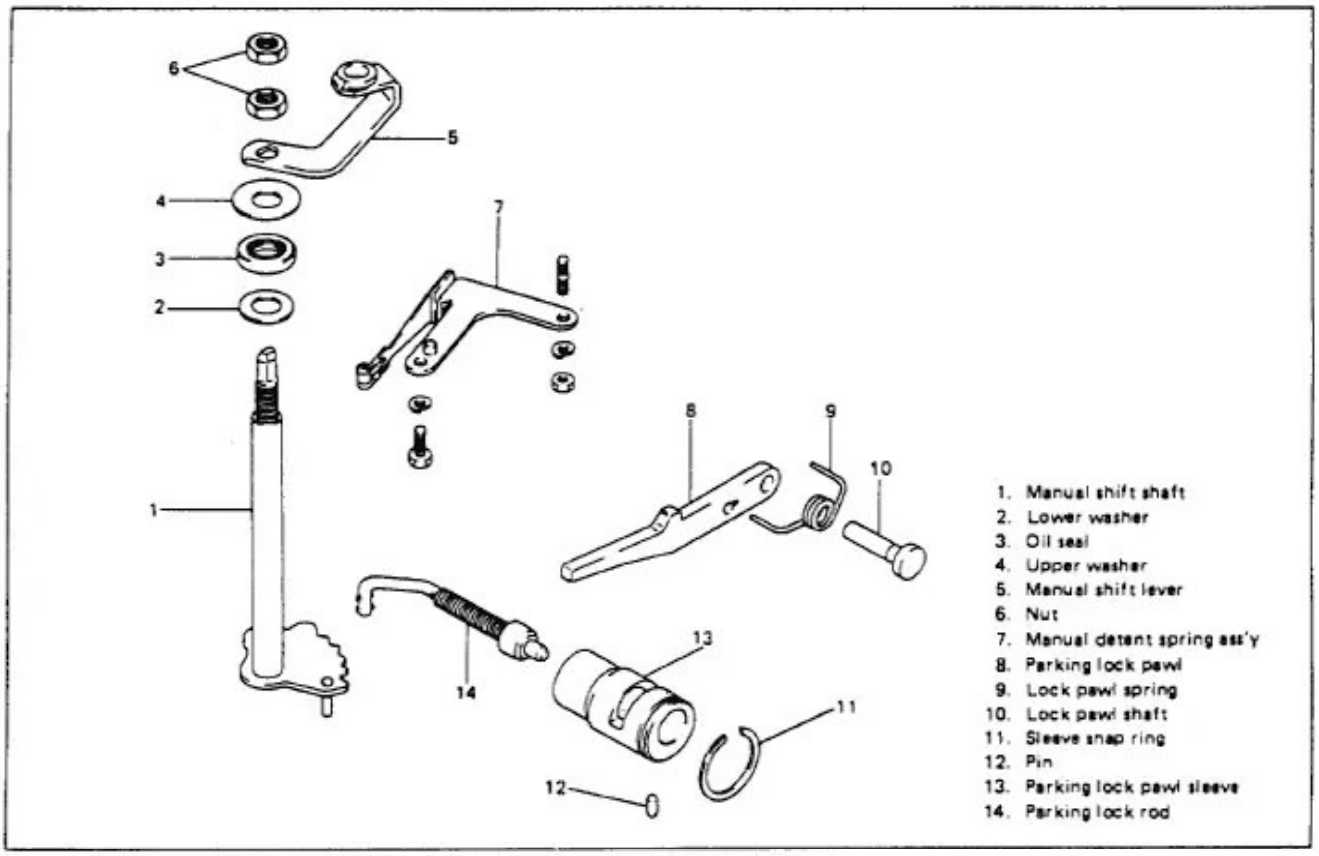


Installing Piston Cover



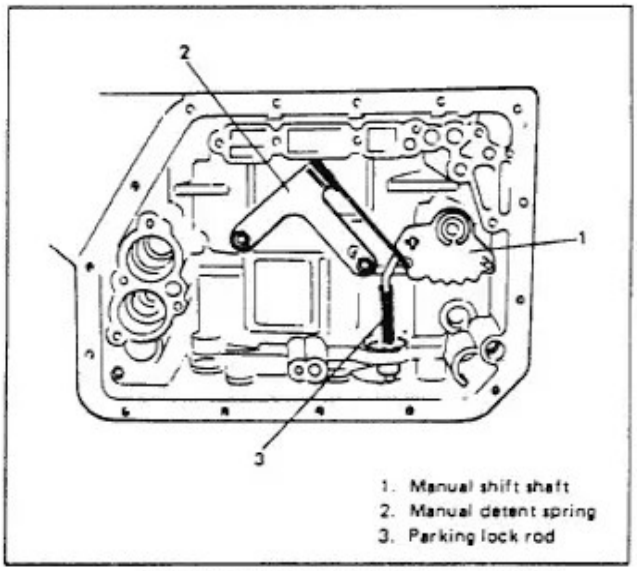
Second Brake Components

2. Manual shift shaft and parking lock pawl.

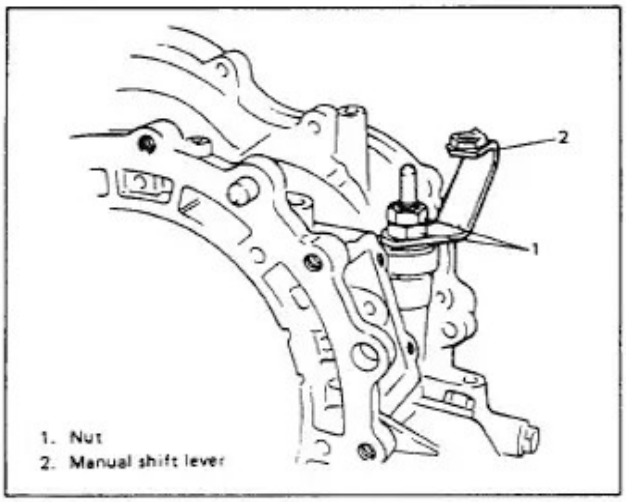


Manual Shift Shaft, Parking Lock Pawl and Related Parts

1) Install lower washer and parking lock rod to manual shift shaft.
2) Manual shift shaft into transaxle case, and then, manual detent spring. Torque bolt and nut of manual detent spring to 0.8 – 1.2 kg-m (8 – 12 N-m, 6.0 – 8.5 lb-ft). Use special care so that manual shift shaft will not damage oil seal lip when passing through it.
3) Shift shaft upper washer and then manual shift lever to manual shift shaft. Tighten 2 nuts (Upper and lower nuts) as follows.
   a. Tighten lower nut to 2.7 – 3.3 kg-m (27 – 33 N-m, 20.0 – 23.5 lb-ft) torque.
   b. Tighten upper nut to 2.7 – 3.3 kg-m (27 – 33 N-m, 20.0 – 23.5 lb-ft) torque.
4) After tightening nuts, check manual shift shaft for smooth rotation.

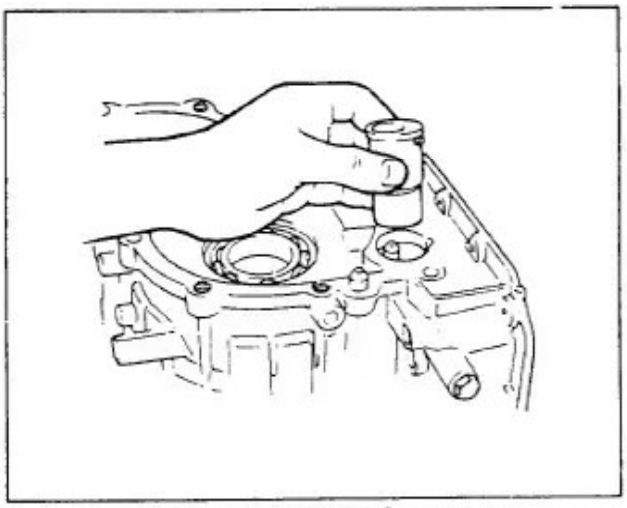


Installing Manual Shift Shaft and Manual Detent Spring



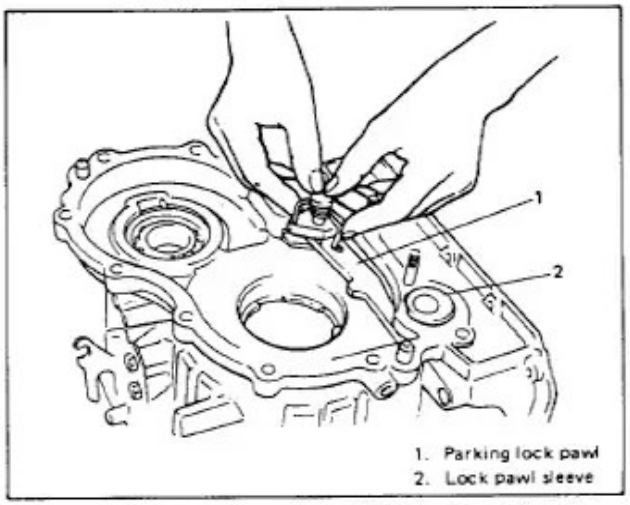
Upper and Lower Nuts

5) Restrictor pin and snap ring to parking lock pawl sleeve and then install to case.



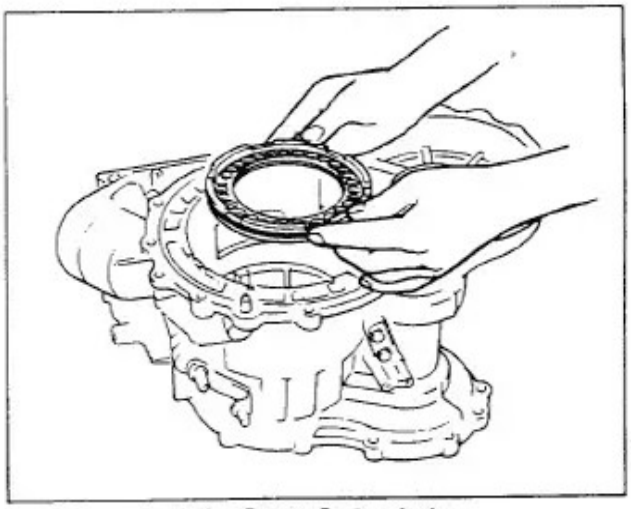
Installing Parking Lock Pawl Sleeve

6) Parking lock pawl.
   a. Shift manual shift lever to a position other than "parking" position.
   b. Install parking lock pawl.
   c. Install lock pawl shaft and lock pawl spring, and then, check to make sure that parking lock pawl moves smoothly by moving manual shift lever.

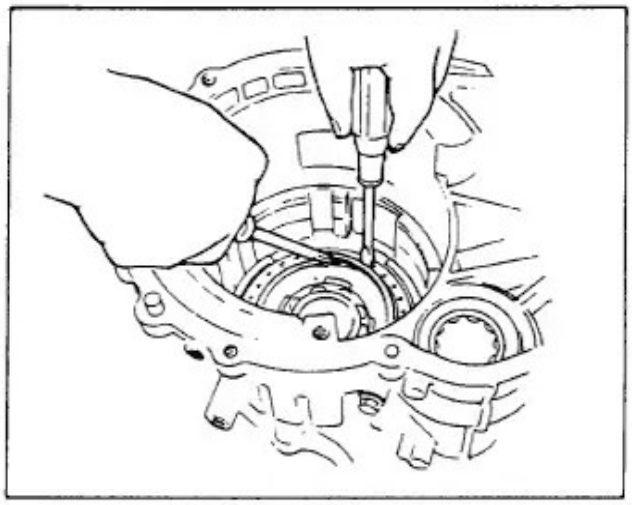


Installing Lock Pawl Shaft and Lock Pawl Spring

3. 1st-reverse brake piston.
1) Apply ATF to inner and outer seals ("O" rings) and fit them to piston. Use new seals.
2) Insert piston into case in such way that the side with spring holes comes to the top. Make sure that seals are not twisted or caught.
3) Place return spring ass'y on piston. Check to make sure that each spring of return spring ass'y is fitted securely in spring hole in piston.
4) Push down return spring ass'y and install snap ring

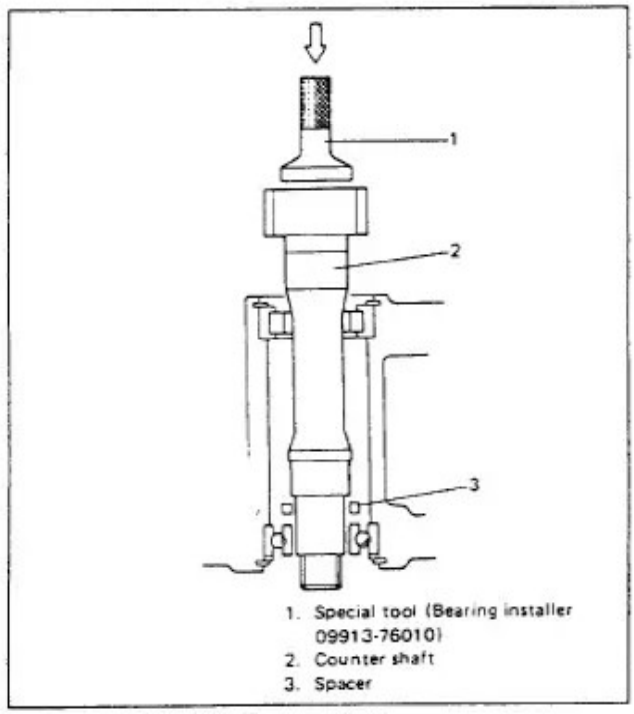


Installing Return Spring Ass'y



Installing Snap Ring

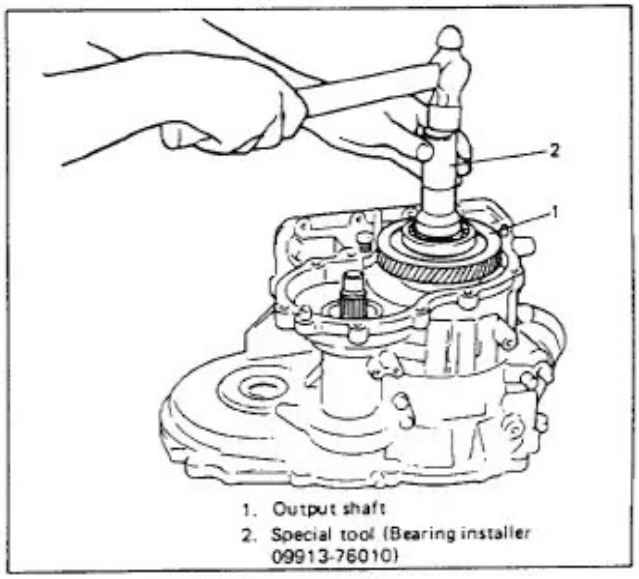
4. Counter shaft.
   Using a special tool (Bearing installer) and a hammer, install counter shaft.
   When inserting counter shaft into case, check to make sure that spacer is in the position as shown in figure. Do not hammer shaft excessively hard, or snap ring and case will be damaged.



1. Special tool (Bearing installer 09913-76010)
2. Counter shaft
3. Spacer

Installing Counter Shaft

5. Output shaft.
1) Shift manual shift lever to a position other than "parking" position.
2) Using a special tool (Bearing installer) and hammer, install output shaft.



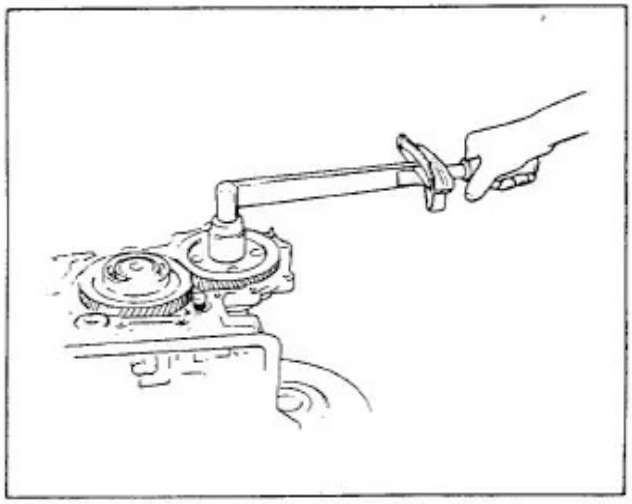
1. Output shaft
2. Special tool (Bearing installer 09913-76010)

Installing Output Shaft

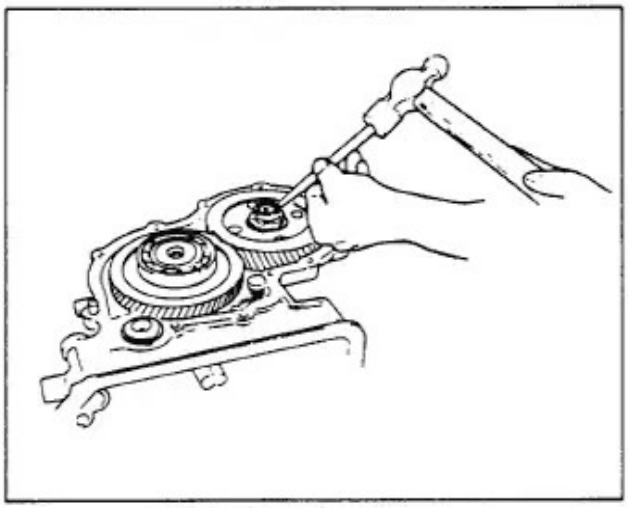
6. Reduction driven gear on counter shaft.
1) Shift manual shift lever to "parking" position so that output shaft is locked and cannot turn.
2) Tighten driven gear nut to specification.

Driven gear nut tightening torque	110 – 150 N·m 11 – 15 kg-m 80.0 – 108.0 lb-ft

Tighten nut by turning wrench by hand.
Tightening nut by hammering wrench may cause damage to parking lock pawl and output shaft.
3) Using a chisel and a hammer, caulk driven gear nut at two places.



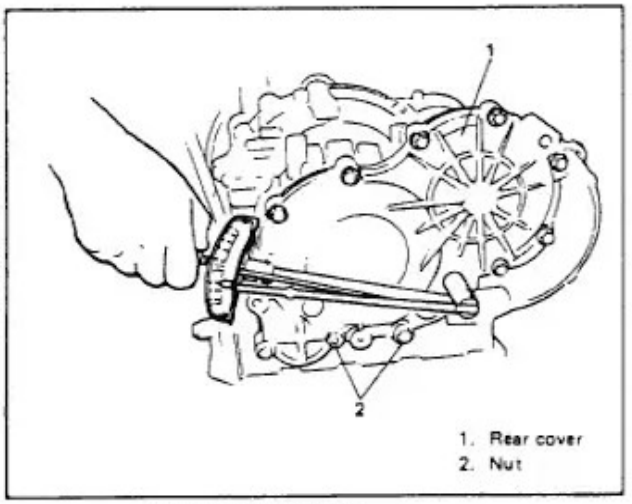
Tightening Driven Gear Nut



Caulking Driven Gear Nut

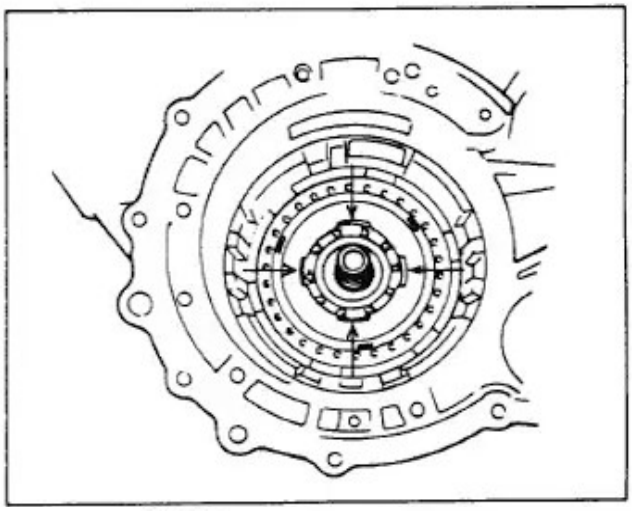
7. Transaxle rear cover.
1) Install rear cover gasket.
2) Install rear cover.
Check that output shaft bearing enters rear cover bearing hole smoothly. Check for abnormal gear sound by rotating output shaft.
3) Install 10 bolts and 2 nuts.
Torque bolts and nuts to following specifications.

Rear cover bolts and nuts tightening torque	Bolt	16 – 23 N·m 1.6 – 2.3 kg-m 12.0 – 16.5 lb-ft
	Nut	11 – 15 N·m 1.1 – 1.5 kg-m 8.0 – 10.5 lb-ft

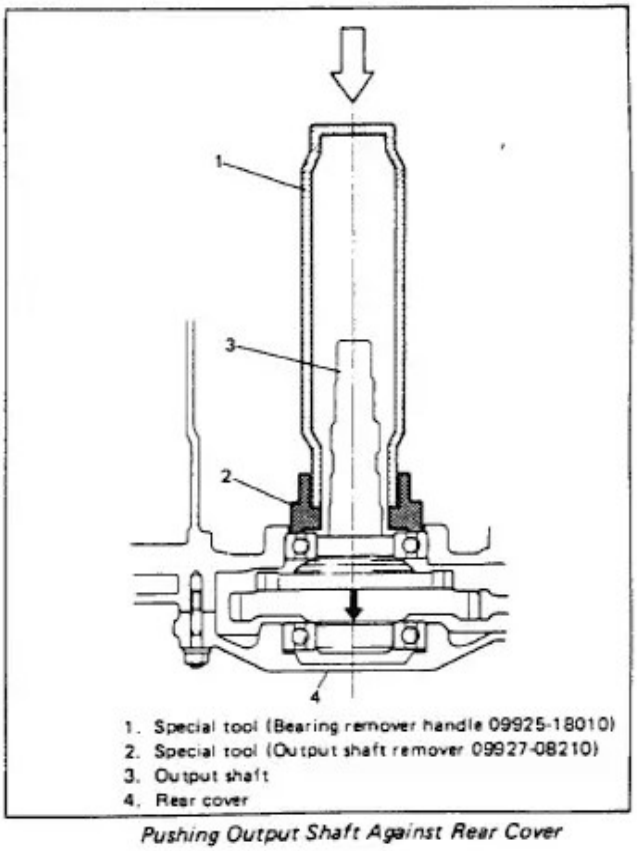


Installing Rear Cover

8. Using special tools (Output shaft remover and Bearing remover handle), push output shaft against rear cover side.
1) Fit 4 projections of special tool (Output shaft remover) to 4 notchs of case.
2) Push bearing and output shaft against rear cover side by tapping special tool (Bearing remover handle) with a hammer lightly.
- Make sure to use special tools. Do not tap output shaft directly with a hammer.
- Be careful not to hammer too hard.

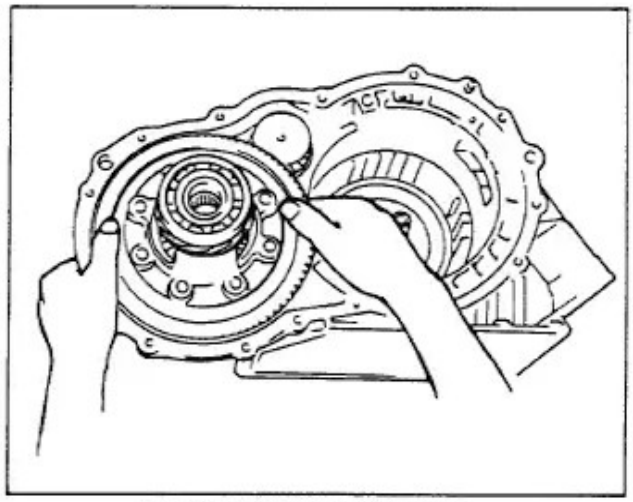


Notches



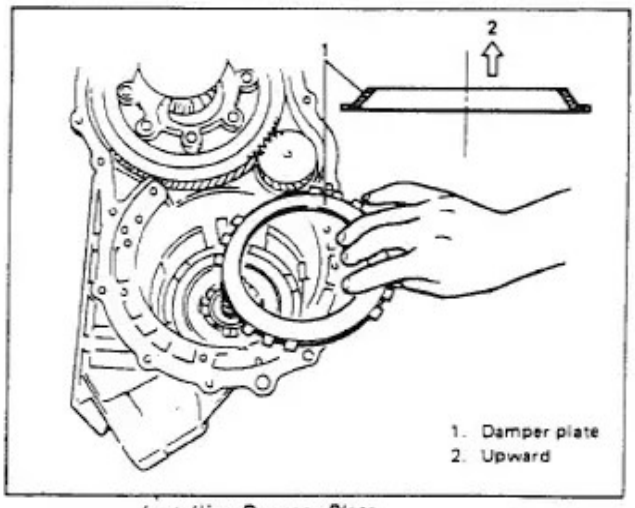
Pushing Output Shaft Against Rear Cover

9. Differential gear assembly.
After engaging teeth of final gear and counter shaft gear, install them. Be careful not to damage gear tooth surface.



Installing Differential Gear Ass'y

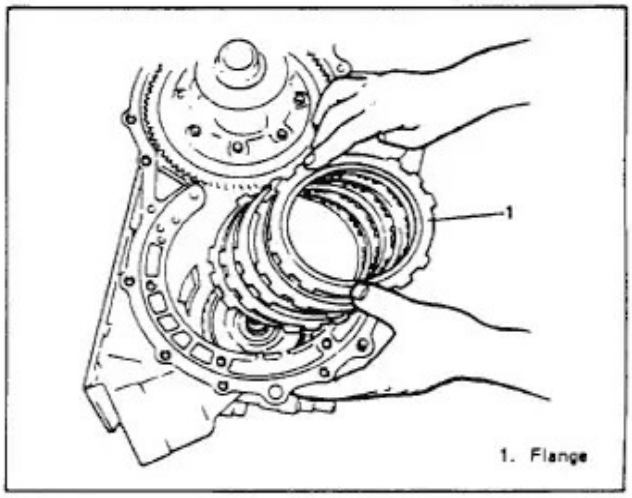
10. 1st-reverse brake parts.
1) Install damper plate to return spring ass'y with convex side upward. Use care not to install in reverse direction.



Installing Damper Plate

2) Install discs, plates and flange. Install in following order:
① Plate ② Disc ③ Plate ④ Disc ⑤ Plate
⑥ Disc ⑦ Plate ⑧ Disc ⑨ Flange (Flat side down)

NOTE:
When using new discs for installation, soak them in ATF for more than 2 hours before installation.

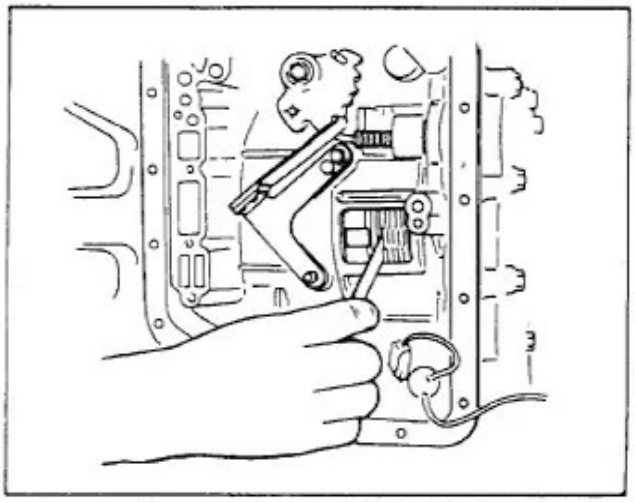


Installing Discs, Plates and Flange

3) Install snap ring.

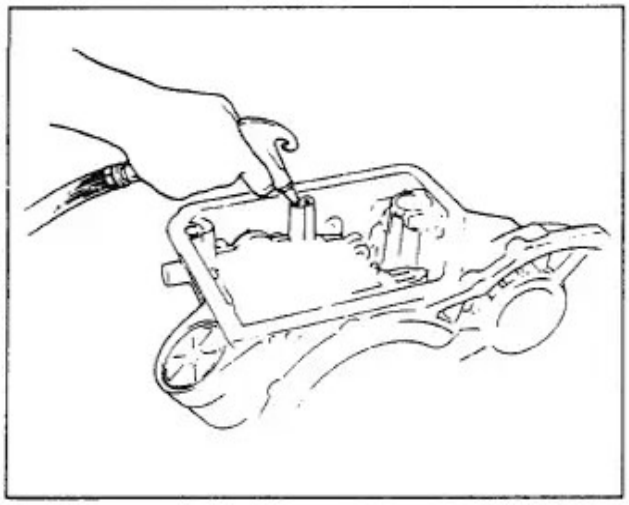
11. Measure 1st-reverse brake clutch clearance.
Measure clearance between snap ring and flange.

1st-reverse brake clutch clearance	0.58 – 1.92 mm (0.023 – 0.075 in)



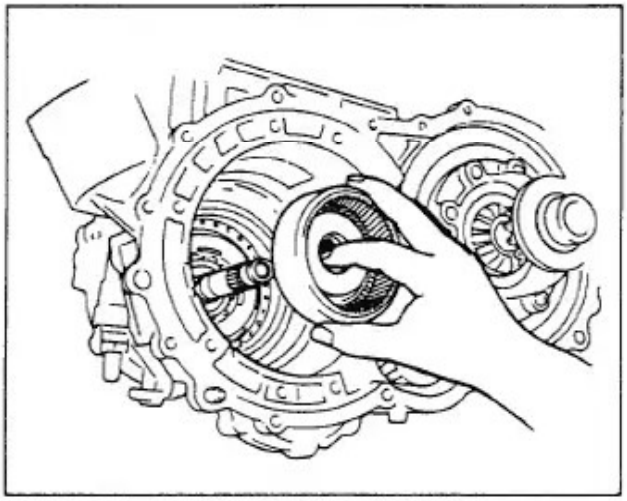
Measuring 1st-reverse Brake Clutch Clearance

12. Check 1st-reverse brake piston for operation.
Check for piston movement by blowing air into oil hole.



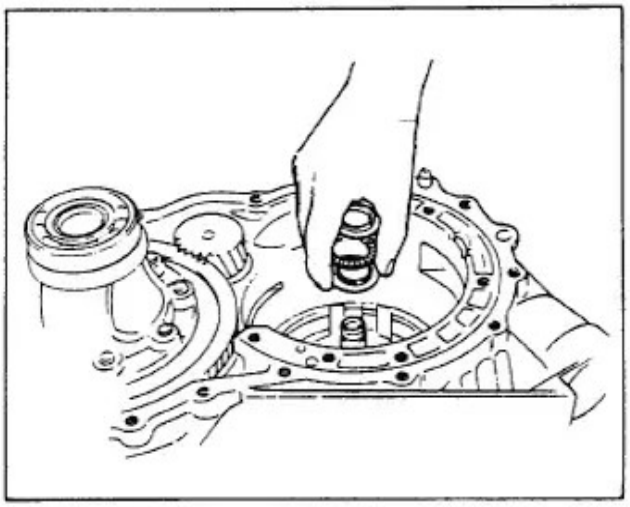
Checking 1st-reverse Brake Piston Movement

13. Rear planetary ring gear.
    Engage ring gear and output shaft spline, and insert.



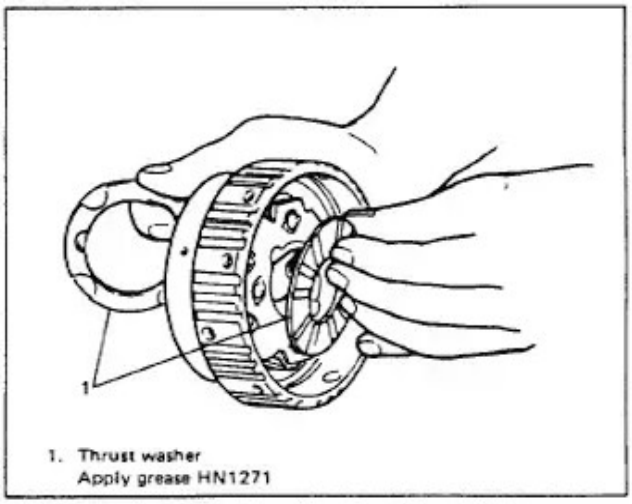
Installing Rear Planetary Ring Gear

14. Rear planetary ring gear races and bearing.
    Install in following order:
    - ① Race (flange side up)
    - ② Bearing
    - ③ Race (flange side up)



Installing Rear Planetary Ring Gear Races and Bearing

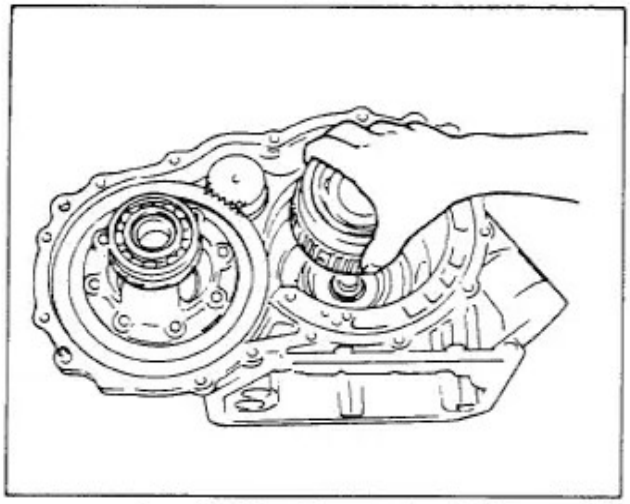
15. Rear planetary thrust washers on rear planetary gear ass'y.
    Apply grease to thrust washers and fit them before and behind gear ass'y, one each.
    Make sure that different lug shapes match slots in gear ass'y.



1. Thrust washer
   Apply grease HN1271

Installing Rear Planetary Thrust Washers

16. Rear planetary gear ass'y.
    Install with teeth of 1st-reverse brake discs aligned.
    After installing rear planetary gear ass'y; check thrust washers and races for proper installation by moving rear planetary gear ass'y up and down lightly with hand. If gear ass'y makes clear sound like "Click" when moved up and down, they are installed in place. But if no sound or thick one is heard, it is possible that washers or races are out of place. In such case, remove gear ass'y and check.

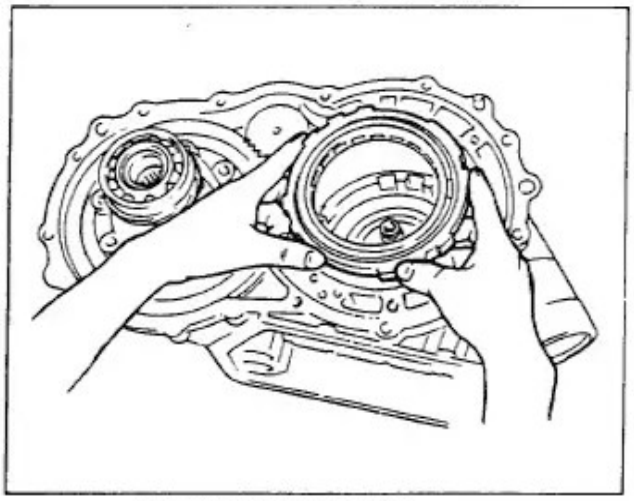


Installing Rear Planetary Gear Ass'y

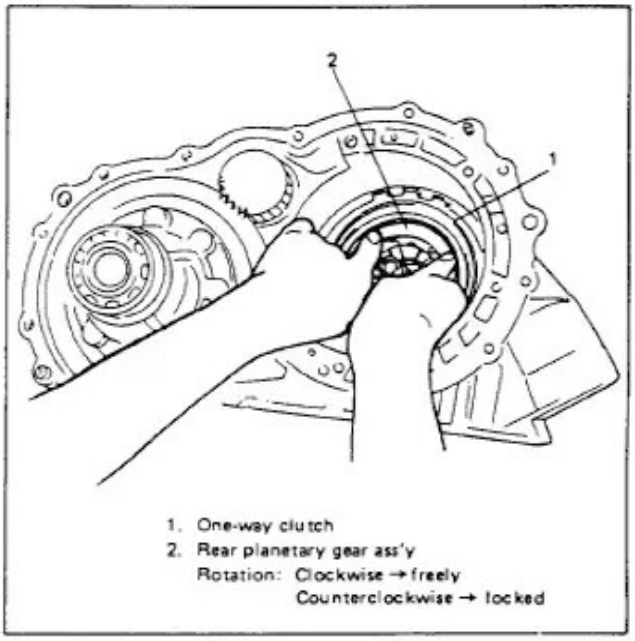
17. One-way clutch race snap ring into the groove of transaxle case.
18. One-way clutch,
    Place one-way clutch on rear planetary gear ass'y and while turning planetary gear ass'y clockwise by hand, insert one-way clutch to correct position.

    NOTE:
    One-way clutch must be installed in a certain direction. Check for its proper installation as follows.

    After installing one-way clutch to rear planetary gear, try turning rear planetary gear clockwise by hand. If it turns clockwise smoothly (freely), that proves proper installation of one-way clutch. However, if it doesn't turn clockwise (locked) and turns counterclockwise smoothly, it means that one-way clutch is installed in wrong direction. In such case, remove one-way clutch, and reinstall it in opposite direction and carry out above described check again to make sure that planetary gear turns smoothly only clockwise.



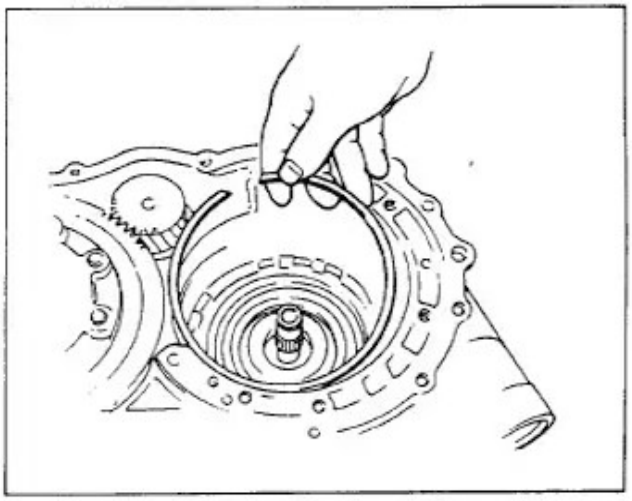
Installing One-way Clutch



1. One-way clutch
2. Rear planetary gear ass'y
   Rotation: Clockwise → freely
   Counterclockwise → locked

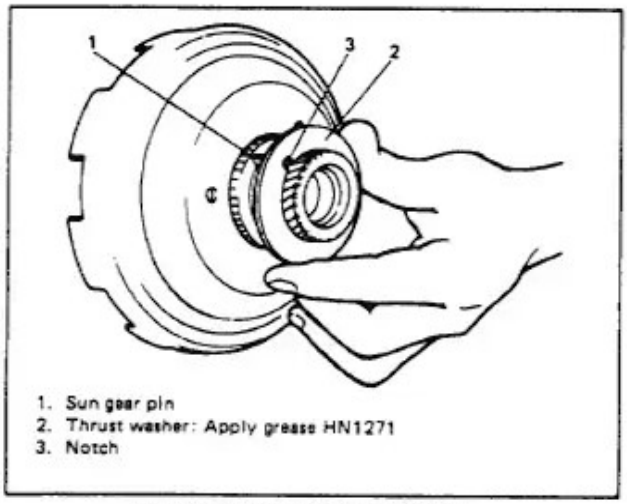
Checking Rear Planetary Gear Rotation

19. One-way clutch race snap ring.
    Push snap ring into place by hand. Visually check to make sure that ring is fully seated. Also, make sure that ends of snap ring are between lugs.



Installing One-way Clutch Race Snap Ring

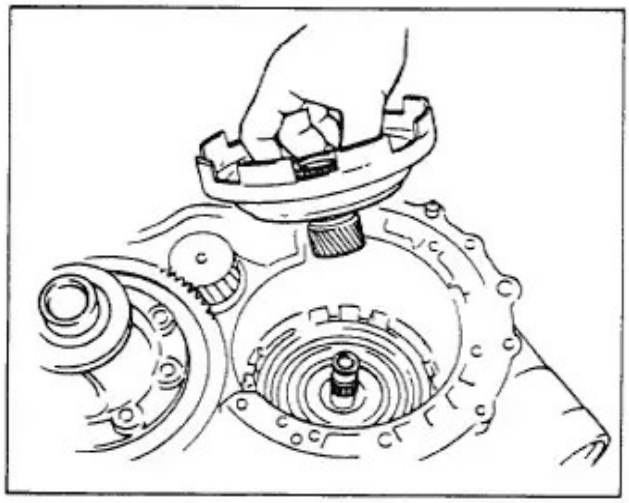
20. Sun gear pin and thrust washer on sun gear ass'y.
Apply grease to thrust washer so that it will not fall off. Check to make sure that pin is fitted in thrust washer notch.



1. Sun gear pin
2. Thrust washer: Apply grease HN1271
3. Notch

Sun Gear Pin and Thrust Washer

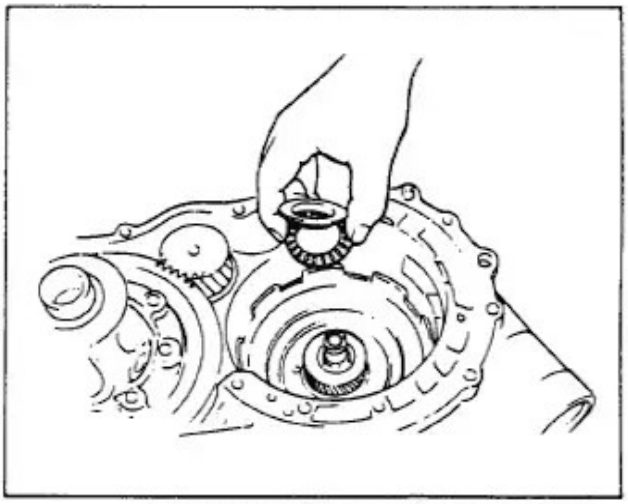
21. Sun gear ass'y.
Push in sun gear while engaging it with rear planetary gear. Be careful not to damage bushing inside sun gear. After installing sun gear, check thrust washers for proper installation by moving sun gear up and down lightly with finger. If sun gear makes clear sound like "Click" when moved up and down, they are installed in place. But if no sound or thick one is heard, it is possible that washers are out of places. In such case, remove sun gear and check.



Installing Sun Gear Ass'y

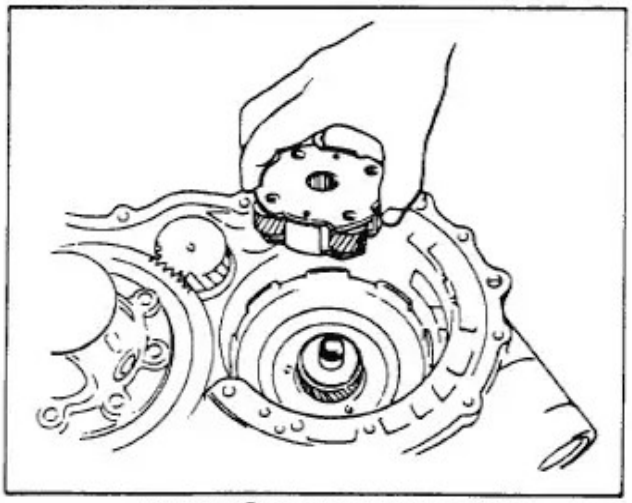
22. Front planetary gear bearing and race.
Install to sun gear in following order

① Bearing
② Race (flange side down)



Installing Front Planetary Gear Bearing and Race

23. Front planetary gear ass'y.
Install front planetary gear ass'y while turning it clockwise or counterclockwise.
After installing front planetary gear ass'y, check bearing and race installed in step 22 for proper installation by moving planetary gear ass'y up and down lightly with finger. If planetary gear ass'y makes clear sound like "Click" when moved up and down, they are installed in place. But if no sound or thick one is heard, it is possible that bearing and race are out of place. In such case, remove planetary gear ass'y and check.

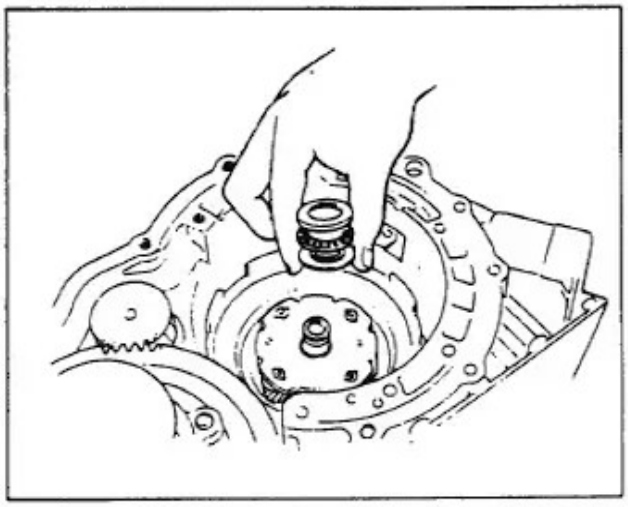


Installing Front Planetary Gear Ass'y

24. Ring gear bearing and races on front planetary gear ass'y.
Install in following order:

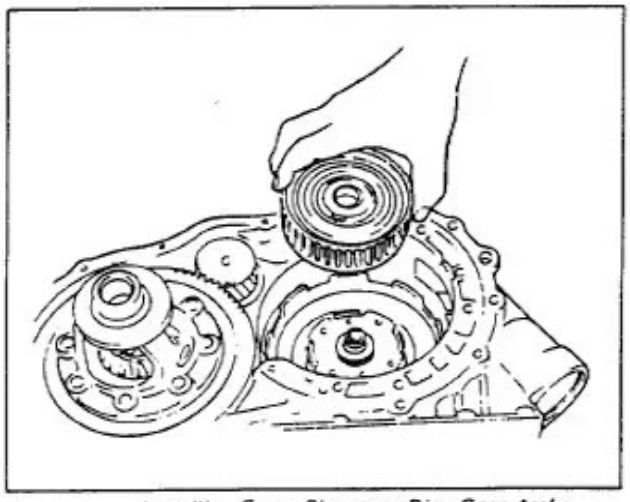
① Race (flange side up)
② Bearing
③ Race (flange side down)

Refer to page 7A1-81 for proper installation.



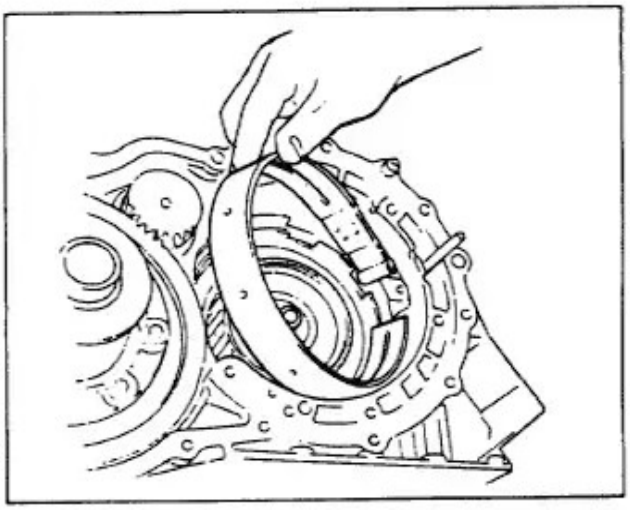
Installing Ring Gear Races and Bearing

25. Front planetary ring gear ass'y
After installing front planetary ring gear ass'y, check bearing and races installed in step. 24 for proper installation by moving ring gear ass'y up and down lightly with finger. If ring gear ass'y makes clear sound like "Click" when moved up and down, they are installed in place. But if no sound or thick one is heard, it is possible that bearing and races are out of place. In such case, remove ring gear ass'y and check.



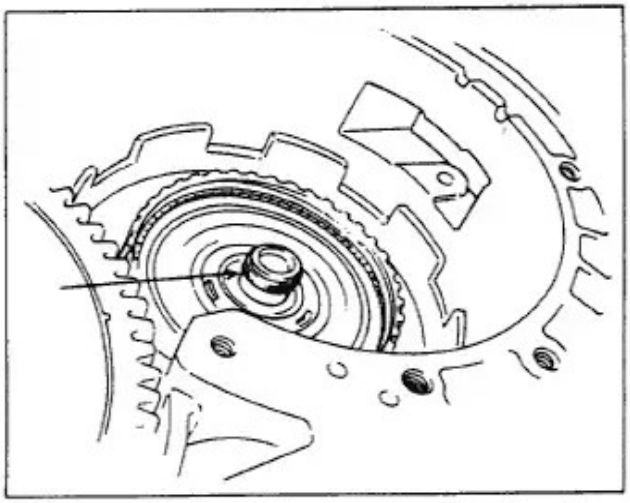
Installing Front Planetary Ring Gear Ass'y

26. Second brake band.
After making sure for correct installing direction, install second brake band in case.
Be careful not to bend second brake band too much or damage it.



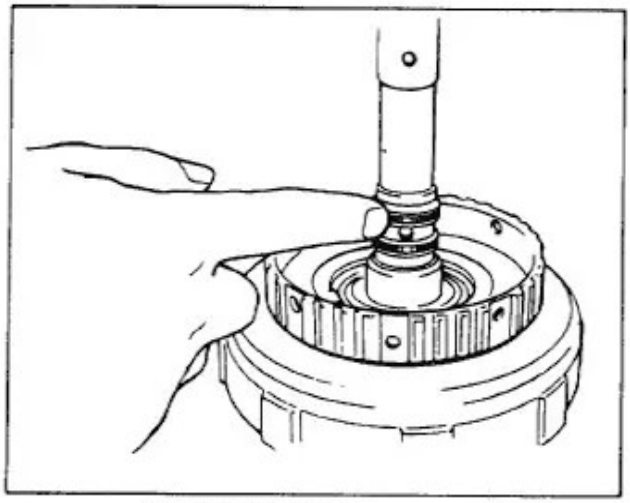
Installing Second Brake Band

27. Inspect output shaft seal ring for wear or damage, and replace if necessary.
Do not expand seal ring excessively when installing.



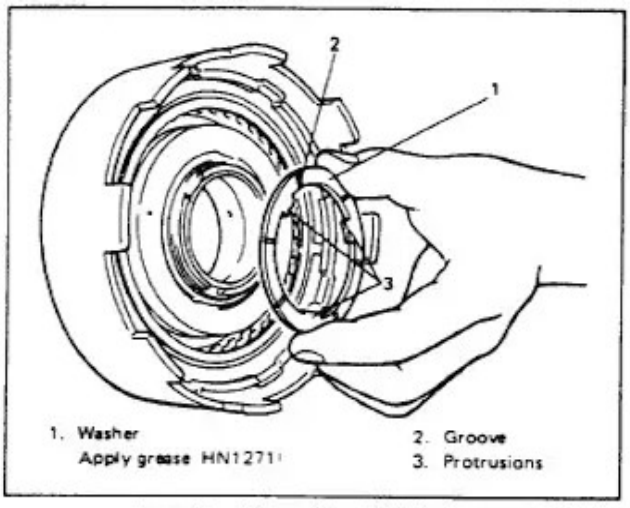
Output Shaft Seal Ring

28. Input shaft seal rings on input shaft.
When installing input shaft seal rings, apply grease to grooves in input shaft before installation.
Do not expand seal ring excessively.



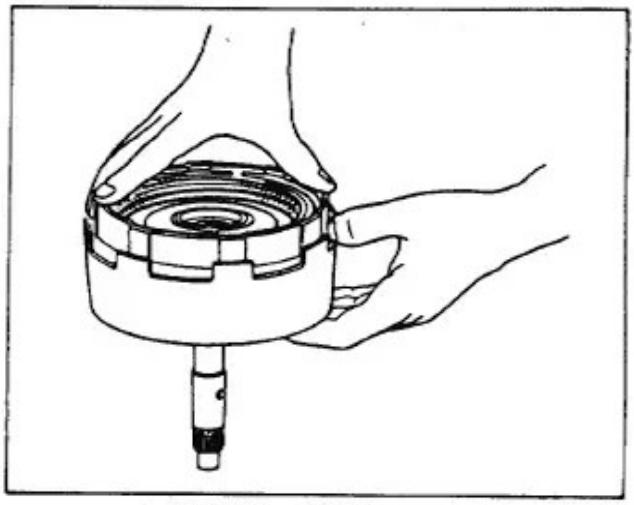
Input Shaft Seal Rings

29. Direct clutch washer on direct clutch.
Apply grease to washer, and install it on direct clutch with its grooved face outward and aligning washer protrusions to direct clutch drum groove.



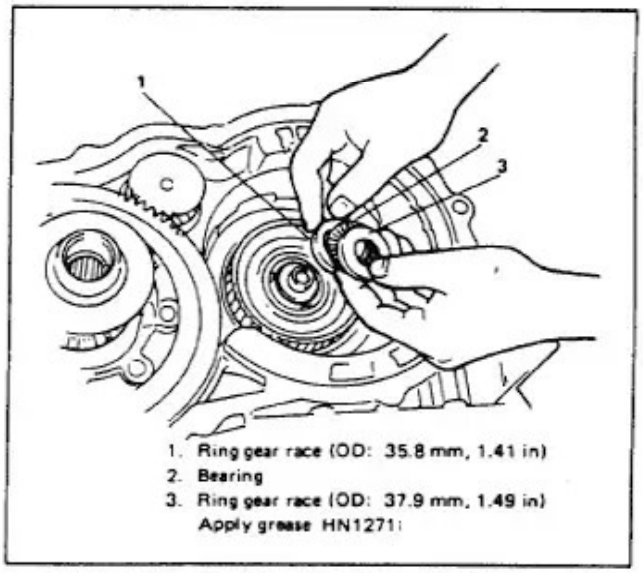
Installing Direct Clutch Washer

30. Direct clutch on input shaft.
Align teeth of direct clutch discs and then install direct clutch on input shaft.
After installing direct clutch, check it for proper installation by moving it up and down lightly by hand. If direct clutch makes clear sound like "Click" when moved up and down, it is installed in place. But if no sound or thick one is heard, it is possible that direct clutch is not installed correctly. In such case, remove direct clutch and reinstall.



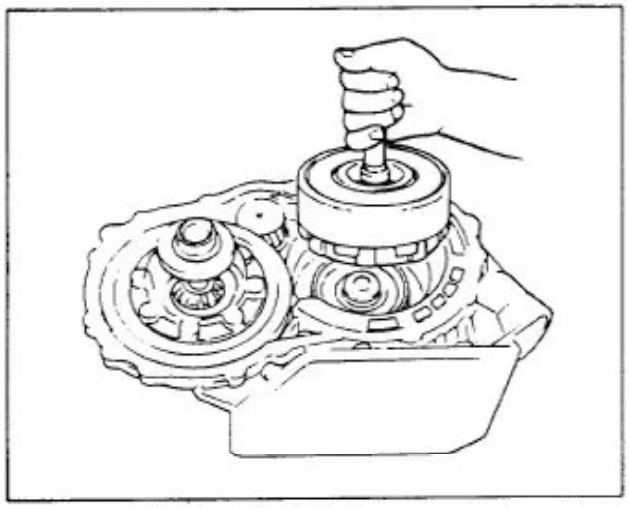
Installing Direct Clutch

31. Ring gear races and bearing.
Apply grease to ring gear races and bearing. Install ring gear race (OD: 35.8 mm, 1.41 in) on ring gear with its flange side down. Another ring gear race (OD: 37.9 mm, 1.49 in) and bearing are attached on input shaft.



Installing Ring Gear Races and Bearing

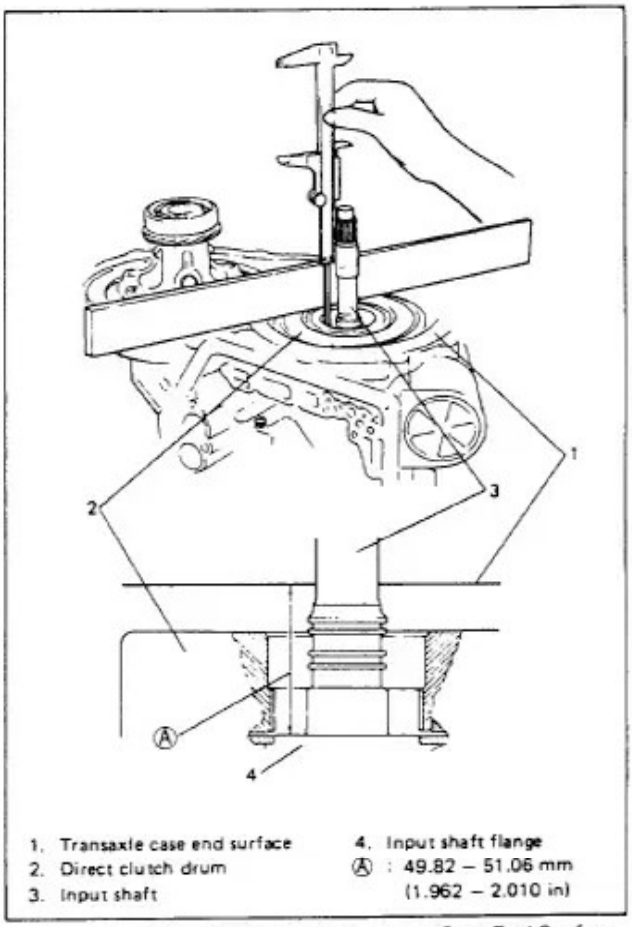
32. Input shaft and forward/direct clutch ass'y.
Hold input shaft with direct clutch installed by hand and while turning it back and forth, insert it into case.
Align teeth of forward clutch discs before installation.
When installing input shaft, be careful so that its bearing and race will not fall off.
Be careful not to damage output shaft seal.
After installing input shaft, check it for proper installation by moving it up and down lightly by hand. If input shaft makes clear sound like "Click" when moved up and down, it is installed in place. But if it doesn't, that means it is not installed in proper position. So try again for proper installation.



Installing Input Shaft

33. Check for correct installation of each component parts as follows.
After installing input shaft, check to make sure that each component is installed properly according to following description.
Place steel straightedge on transaxle case end surface, and measure the distance Ⓐ shown in figure by using vernier. For the distance Ⓐ, subtract the width of straightedge from vernier reading.
If measured distance Ⓐ is within following specification, it means that component parts other than direct clutch are installed properly. If out of specification, disassemble component parts and re-install them properly.

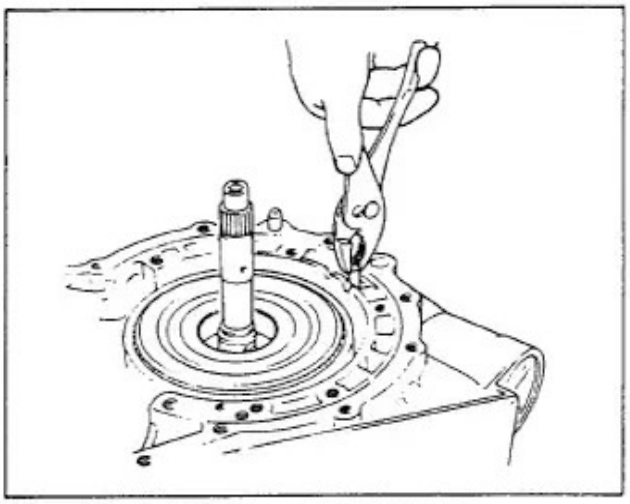
Distance Ⓐ	49.82 – 51.06 mm (1.962 – 2.010 in)



1. Transaxle case end surface
2. Direct clutch drum
3. Input shaft
4. Input shaft flange
Ⓐ : 49.82 – 51.06 mm (1.962 – 2.010 in)

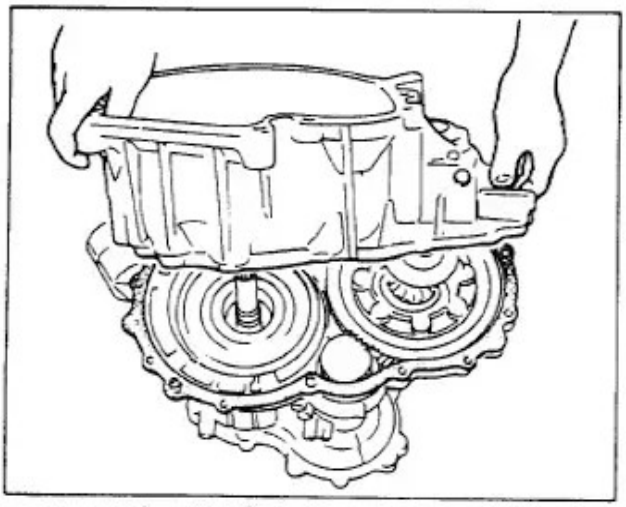
Measuring Distance Between Case End Surface and Input Shaft Flange

34. Second brake band pin.
Align hole in second brake band with case pin hole and insert brake band pin.
Apply ATF to brake band pin before installation.



Installing Second Brake Band Pin

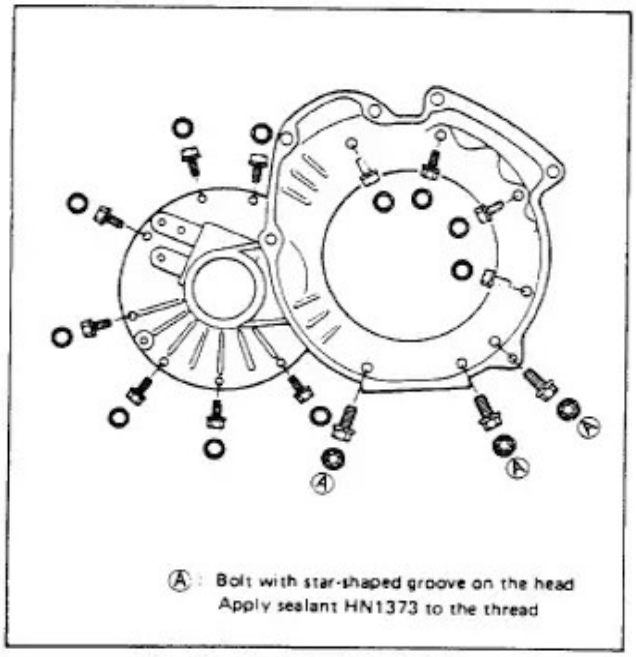
35. Case gasket and transaxle case housing.
Use new gasket. Install gasket using care so that it will not protrude inside.



Installing Gasket and Case Housing

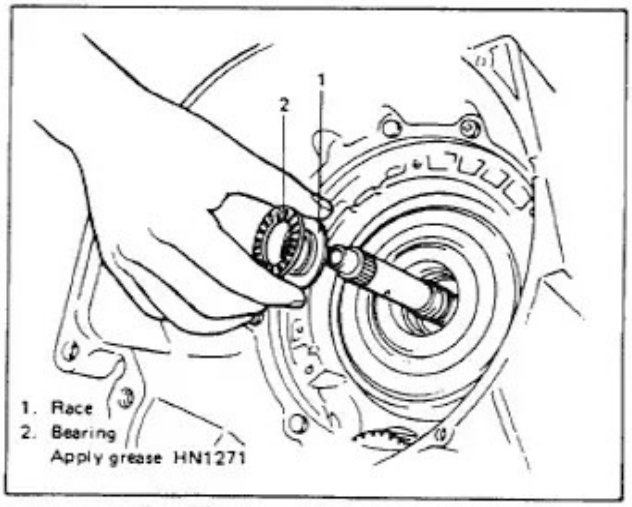
36. Among 14 bolts of case housing bolts, 3 bolts have star-shaped groove in their heads. Install these 3 bolts in such positions as shown by Ⓐ in figure after applying sealant to their threads. Do not apply thread locking compound to housing bolts. Tighten case housing bolts to specification.

Case housing bolts tightening torque	16 – 23 N·m 1.6 – 2.3 kg-m 12.0 – 16.5 lb-ft



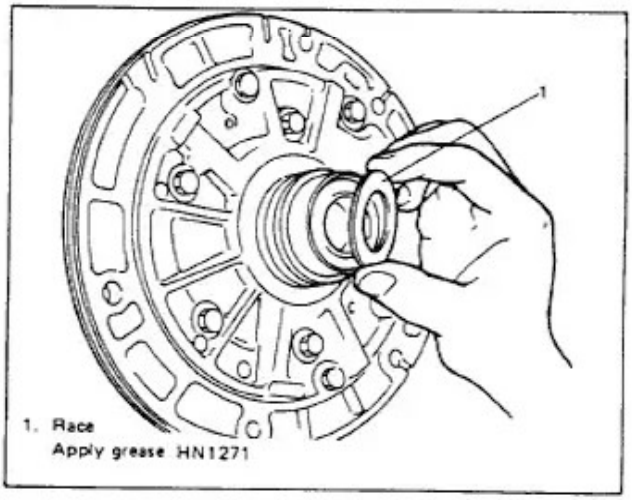
Case Housing Bolts Installation

37. Input shaft bearing race and bearing on input shaft.
Grease bearing race and install it with its flange side outward together with bearing.
Install so that bearing does not get on bearing race flange.



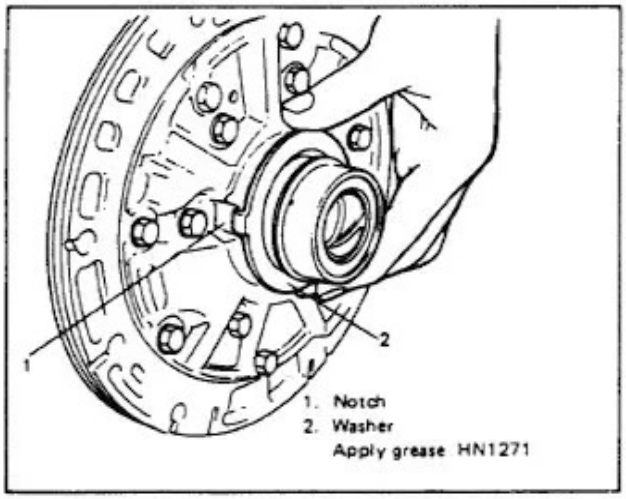
Installing Input Shaft Bearing and Race

38. Another input shaft bearing race on oil pump.
Grease bearing race and attach it to oil pump body.



Installing Another Input Shaft Bearing Race

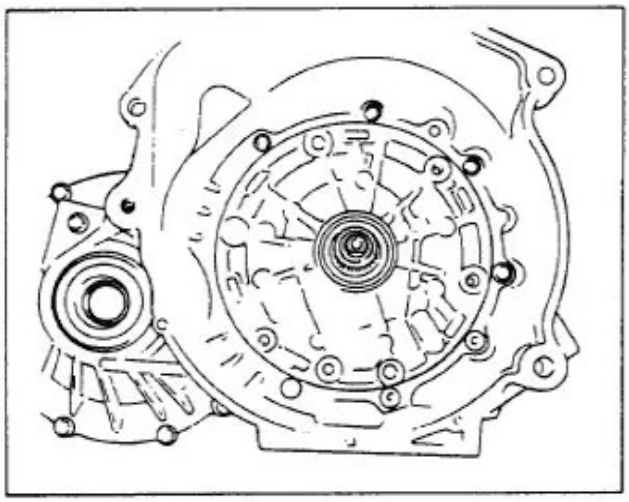
39. Direct clutch washer on oil pump.
Attach greased washer on oil pump.
Fit washer flange into notch of oil pump body.



Installing Direct Clutch Washer

40. New oil pump cover seal ("O" ring) to oil pump.
Install greased cover seal on outer groove of oil pump.
Make sure that cover seal is not twisted or extruded.
41. Oil pump to transaxle case.
Align oil pump bolt hole with case bolt hole and push in pump gently by hand until it contacts case. Use care so that direct clutch washer does not fall off, and input shaft seal rings and pump cover seal rings will not come off or get damaged.
Tighten 6 oil pump bolts gradually to specification.

Oil pump bolts tightening torque	18 – 27 N·m 1.8 – 2.7 kg-m 13.5 – 19.5 lb-ft



Installing Oil Pump

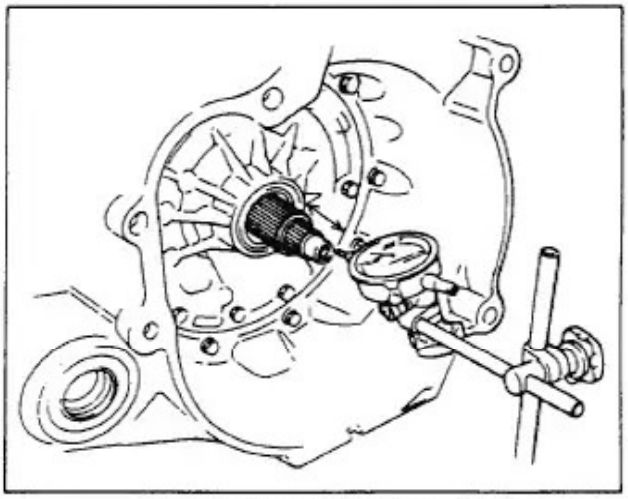
42. Check input shaft end play.
Apply dial gauge onto input shaft end surface and measure thrust play of input shaft.

Input shaft thrust play	0.3 – 0.9 mm (0.012 – 0.035 in)

If out of above specification, remove oil pump and replace input shaft bearing race on oil pump side (Refer to page 7A1-96) with either of the following.

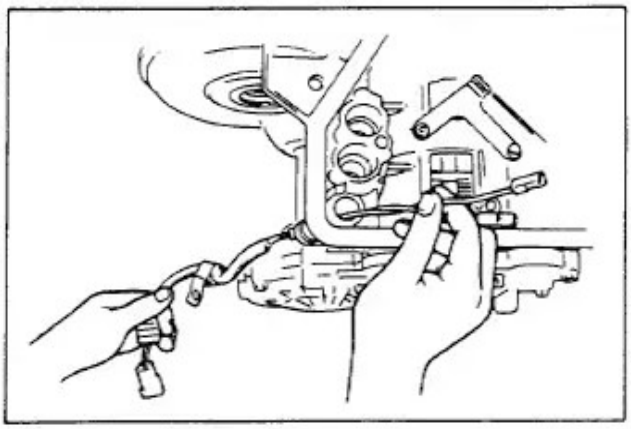
	Bearing race thickness
Available input shaft bearing race (oil pump side)	0.8 mm (0.031 in)
	1.4 mm (0.055 in)

Check to make sure that input shaft turns smoothly.

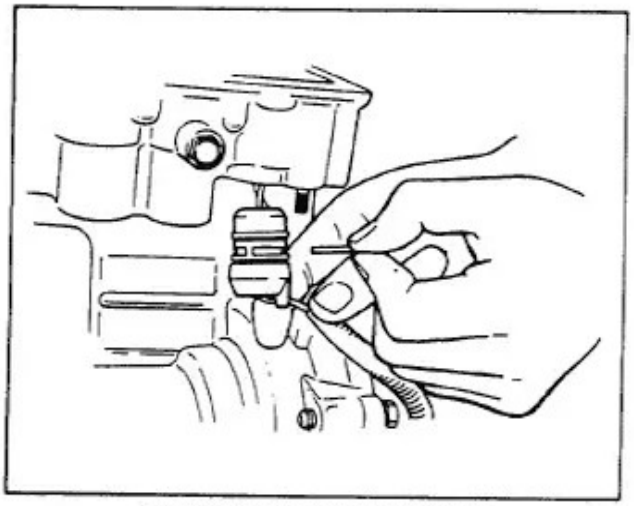


Measuring Thrust Play of Input Shaft

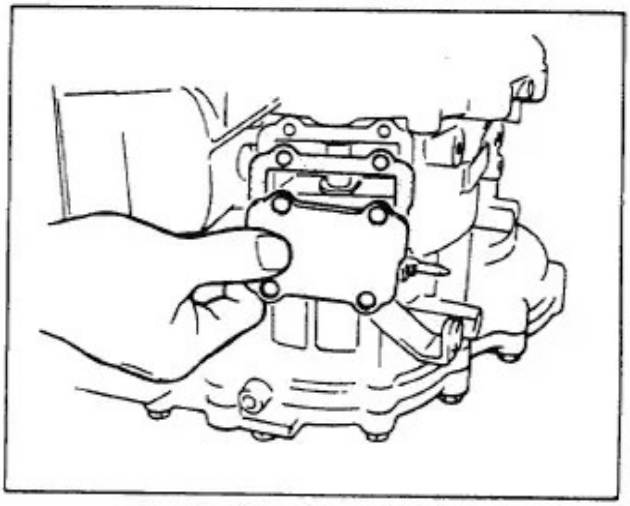
43. Solenoid wire harness to case.
1) Insert solenoid wire hold plate in the groove in solenoid wire grommet and install solenoid wire to stud bolt of transaxle case
2) Secure hold plate with lock washer and nut.
3) Install 2 solenoid wire clamps to rear cover. Secure them with rear cover bolts



Installing Solenoid Wire Harness

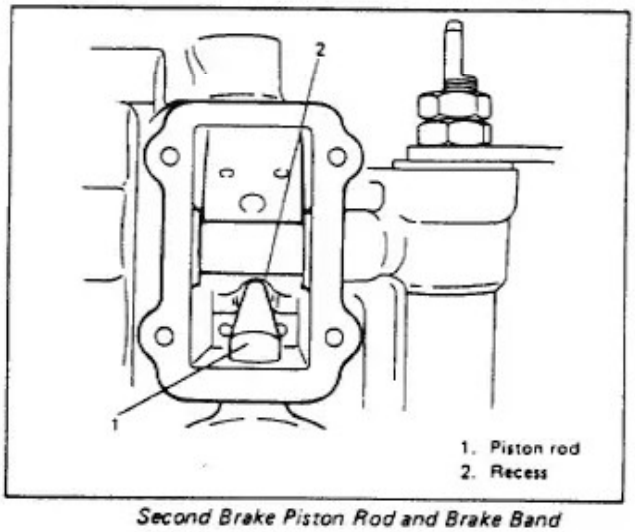


Installing Solenoid Wire Hold Plate



Installing Second Brake Cover

44. Check for correct installation of second brake band.
Looking through second brake band cover hole, check that second brake piston rod end is aligned with the center of recess in brake band as shown in figure. If rod end contacts outside of brake band recess, pull up second brake band by inserting thin wire in brake band fitting so that band recess aligns with rod end properly.



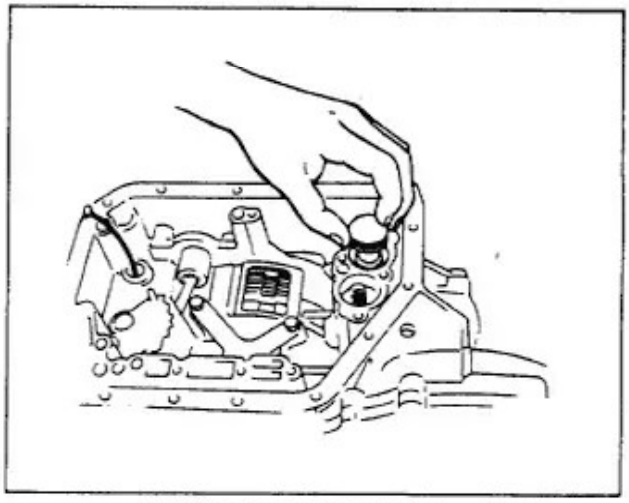
Second Brake Piston Rod and Brake Band Recess

45. Check second brake piston stroke as previously described.

46. Install second brake band cover with new gasket.

Second brake band cover bolts tightening torque	7 – 9 N·m 0.7 – 0.9 kg-m 5.5 – 6.5 lb-ft

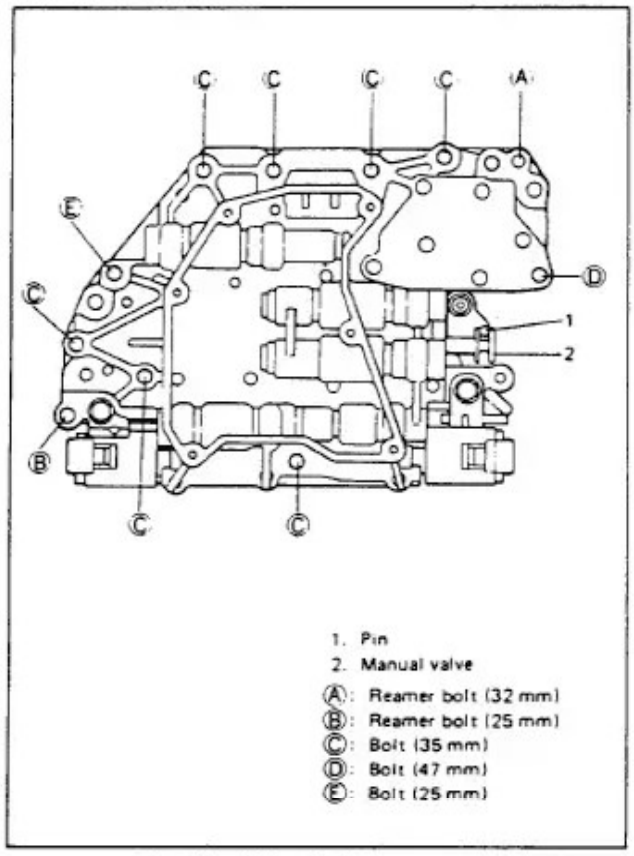
47. Oil pressure control cable in case.
48. Accumulator pistons and spring.
1) Install new seal rings on pistons.
Be sure to apply ATF to pistons and seal rings.
2) Install pistons in case.
Be careful so that seal rings will not fall off.
3) Insert spring into second brake accumulator piston.



Installing Accumulator Pistons and Spring

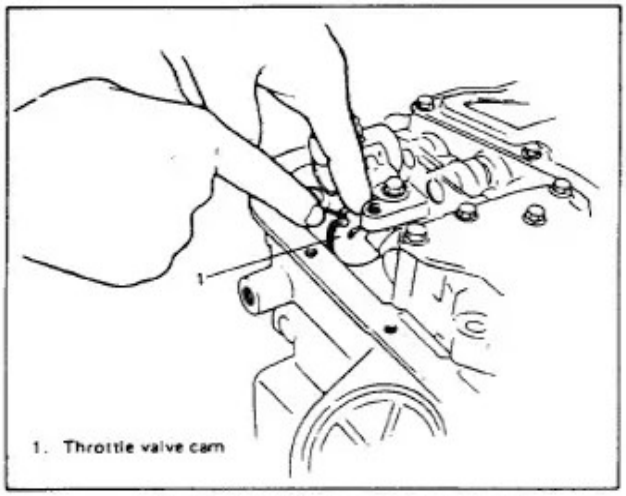
49. Valve body Ass'y on case.
Align manual valve with pin on manual shift lever and lower the valve body into place. Be careful so that accumulator spring will not incline.
Install 11 bolts in lower valve body.
Each bolt length is given in below figure.
First, tighten two reamer bolts (positioning bolts) Ⓐ and Ⓑ lightly. Then tighten all bolts in diagonal order.

Lower valve body bolts tightening torque	8 – 12 N·m 0.8 – 1.2 kg-m 6.0 – 8.5 lb-ft



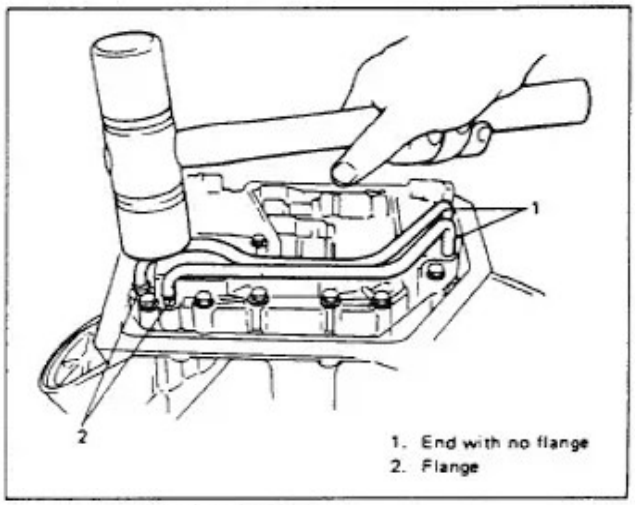
Installing Valve Body

50. Install oil pressure control cable on throttle valve cam. While holding cam down with fingers, slip cable end into slot.



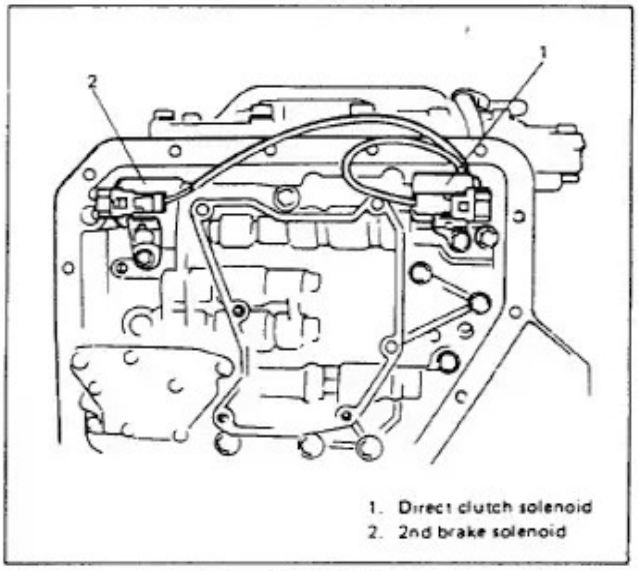
Installing Oil Pressure Control Cable to Throttle Valve Cam

51. Oil tubes to lower valve body.
First put the end of oil tube without flange about 2 mm (0.08 in) into lower valve body, then insert the one with flange and push both ends of tube by hand. Next, tap them in lightly with a plastic hammer as far as flange position.
- Do not deform tubes when installing.
- Install them horizontally to valve body.
- Make sure to insert them up to flange position securely.



Installing Oil Tubes

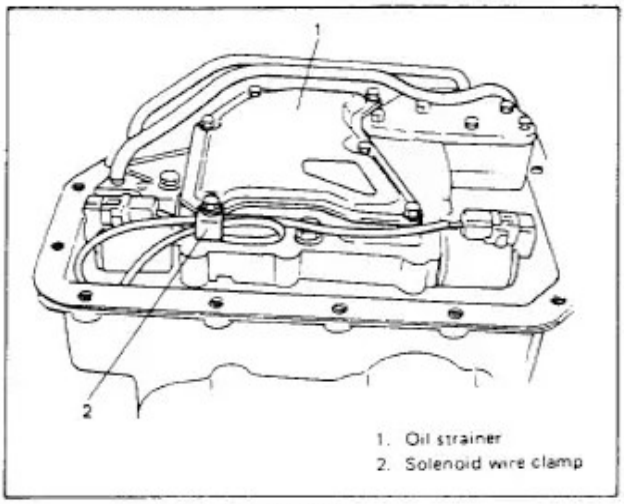
52. 2 solenoid wires; one to direct clutch solenoid and the other to second brake solenoid.



Connecting Solenoid Wires

53. Oil strainer and solenoid wire clamp.
Clamp solenoid wire by fastening solenoid wire clamp with oil strainer bolt in the position as shown in figure.

Oil strainer bolts tightening torque	4 – 6 N·m 0.4 – 0.6 kg-m 3.0 – 4.0 lb-ft



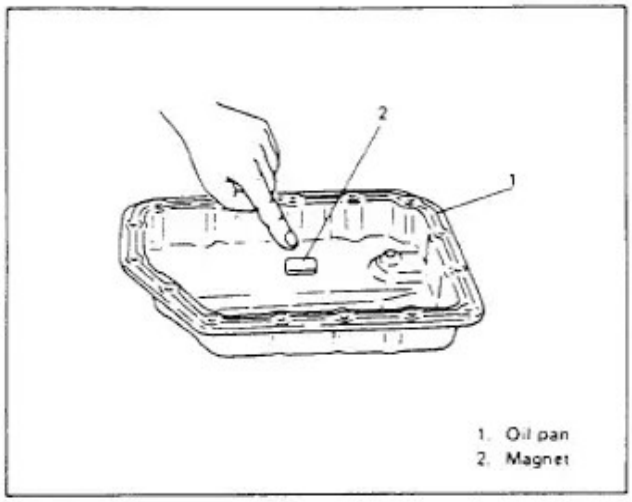
Installing Oil Strainer

54. Magnet in oil pan and oil pan with new gasket.
1) Install magnet in oil pan right under oil strainer as shown below figure.
2) Check to make sure that oil tubes are not in contact with oil pan.
3) There are 15 oil pan bolts in all and two of them have cross groove in their heads. Mount these two cross grooved bolts in such positions as shown after applying sealant to their threads.
Tighten 15 oil pan bolts to specification.

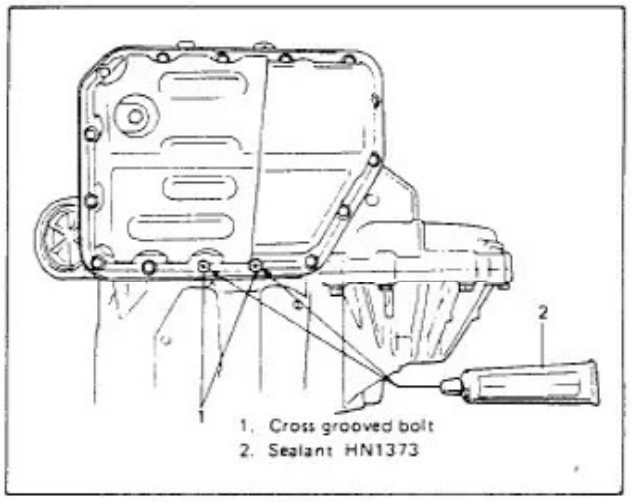
Oil pan bolts tightening torque	4 – 6 N·m 0.4 – 0.6 kg-m 3.0 – 4.0 lb-ft

4) Tighten oil pan drain plug to specification.

Oil pan drain plug tightening torque	18 – 23 N·m 1.8 – 2.3 kg-m 13.5 – 16.5 lb-ft



Installing Magnet in Oil Pan



Installing Oil Pan Bolts

55. Oil filler tube with "O" ring.
Insert oil filler tube in case as far as its flange and tighten with bolt.

Oil filler tube bolt tightening torque	4 – 6 N·m 0.4 – 0.6 kg-m 3.0 – 4.0 lb-ft

1990 GEO METRO COMPUTER CONTROL TRANSAXLE

The Geo Metro computer control transaxle looks like and operates just like a Chevy Sprint transaxle. However, there is a difference in the control system. With the Chevy Sprint we have vacuum switches, an accelerator switch, a shift lever switch, and a speed sensor (figure 1). With the Geo Metro, we see that the accelerator switch and the vacuum switches have been replaced with a throttle position sensor (figure 2 & 3)

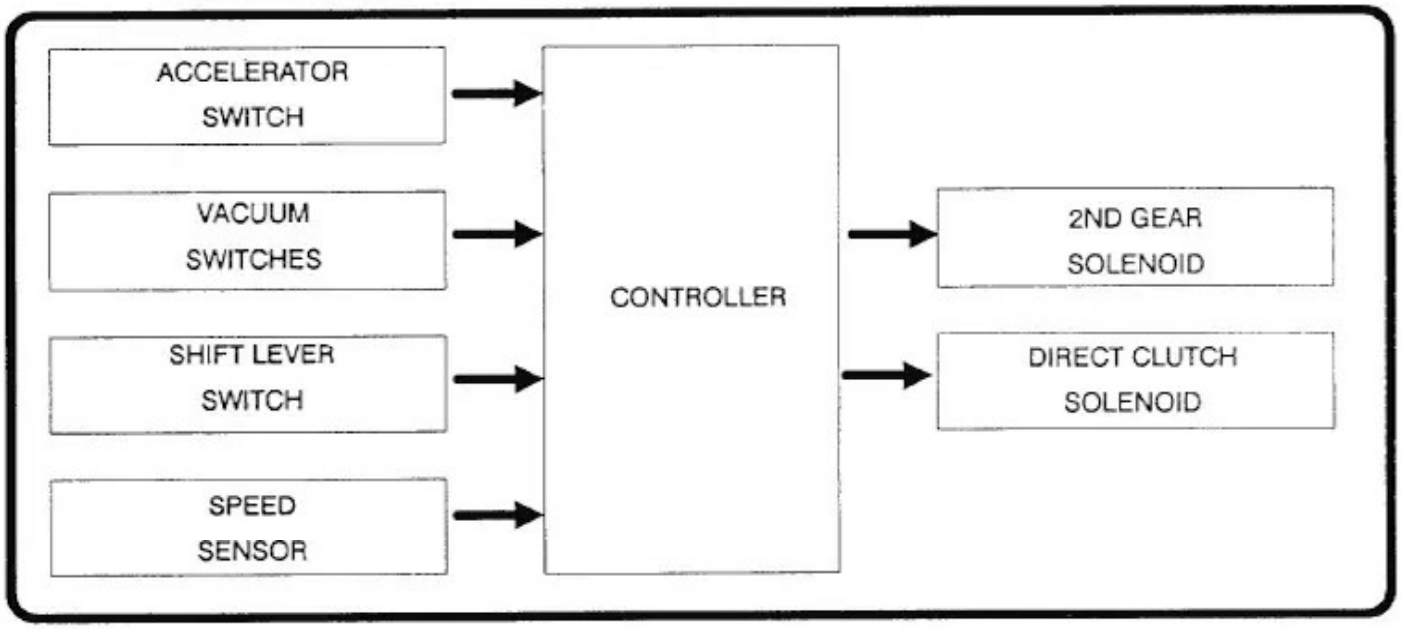


FIGURE 1 - CHEVY SPRINT GEAR SHIFT CONTROL SYSTEM (VACUUM)

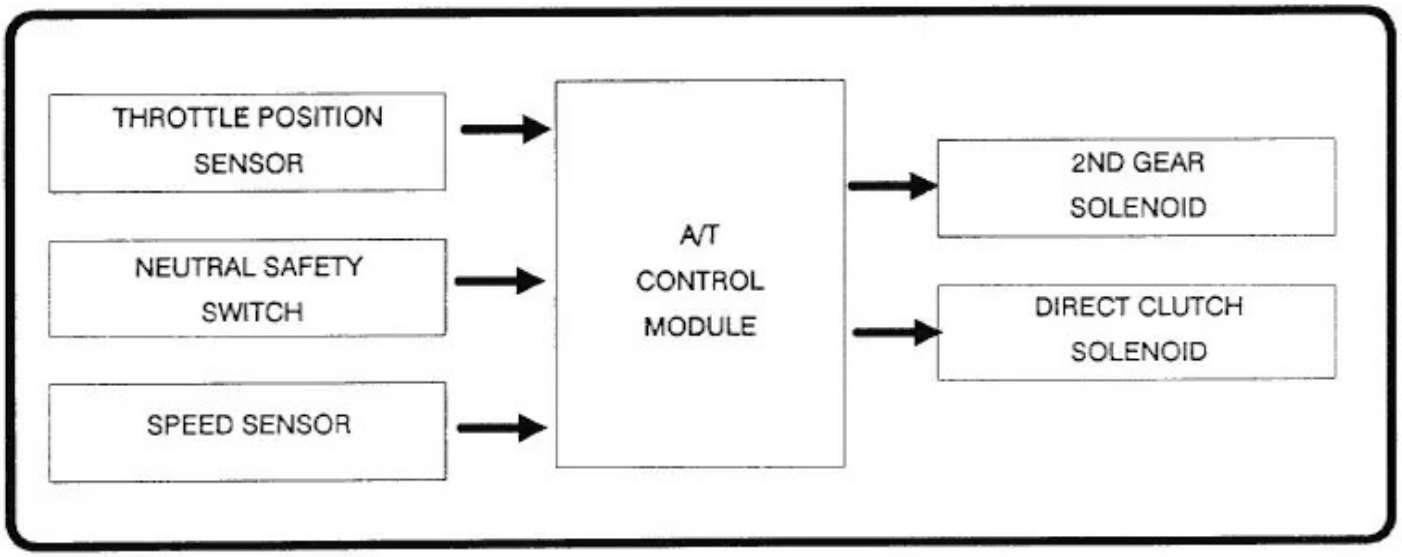


FIGURE 2 - GEO METRO GEAR SHIFT CONTROL SYSTEM (ELECTRICAL)

A - GROUND
B - ON/OFF SIGNAL (IDLE SIGNAL)
C - OUTPUT VOLTAGE (OPENING ANGLE SIGNAL)
D - POWER SUPPLY FROM ECM (REFERENCE VOLTAGE)
1 - THROTTLE POSITION SENSOR
2 - THROTTLE BODY

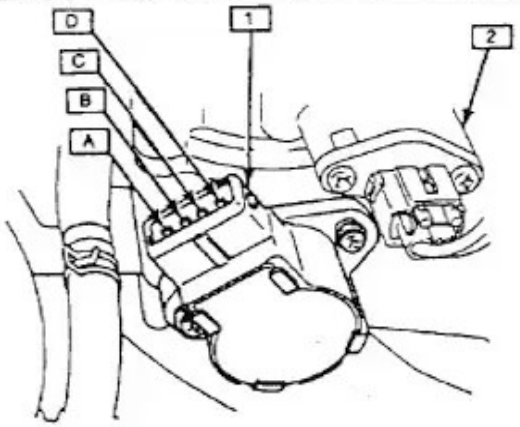
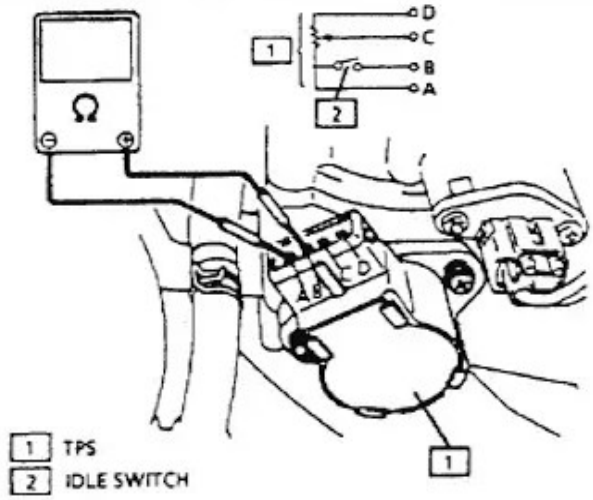


FIGURE 3 - GEO METRO THROTTLE POSITION SENSOR

The throttle position sensor can be easily checked for proper operation at the sensor itself using an ohmmeter (figure 4 &5).

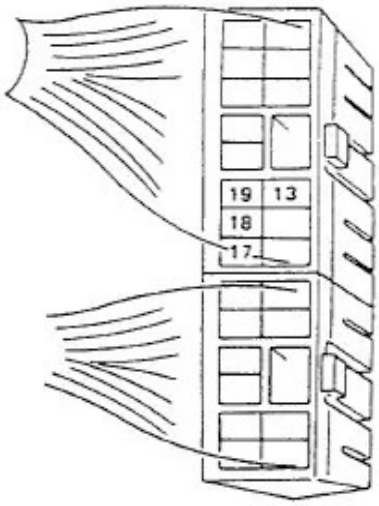


(figure 4)

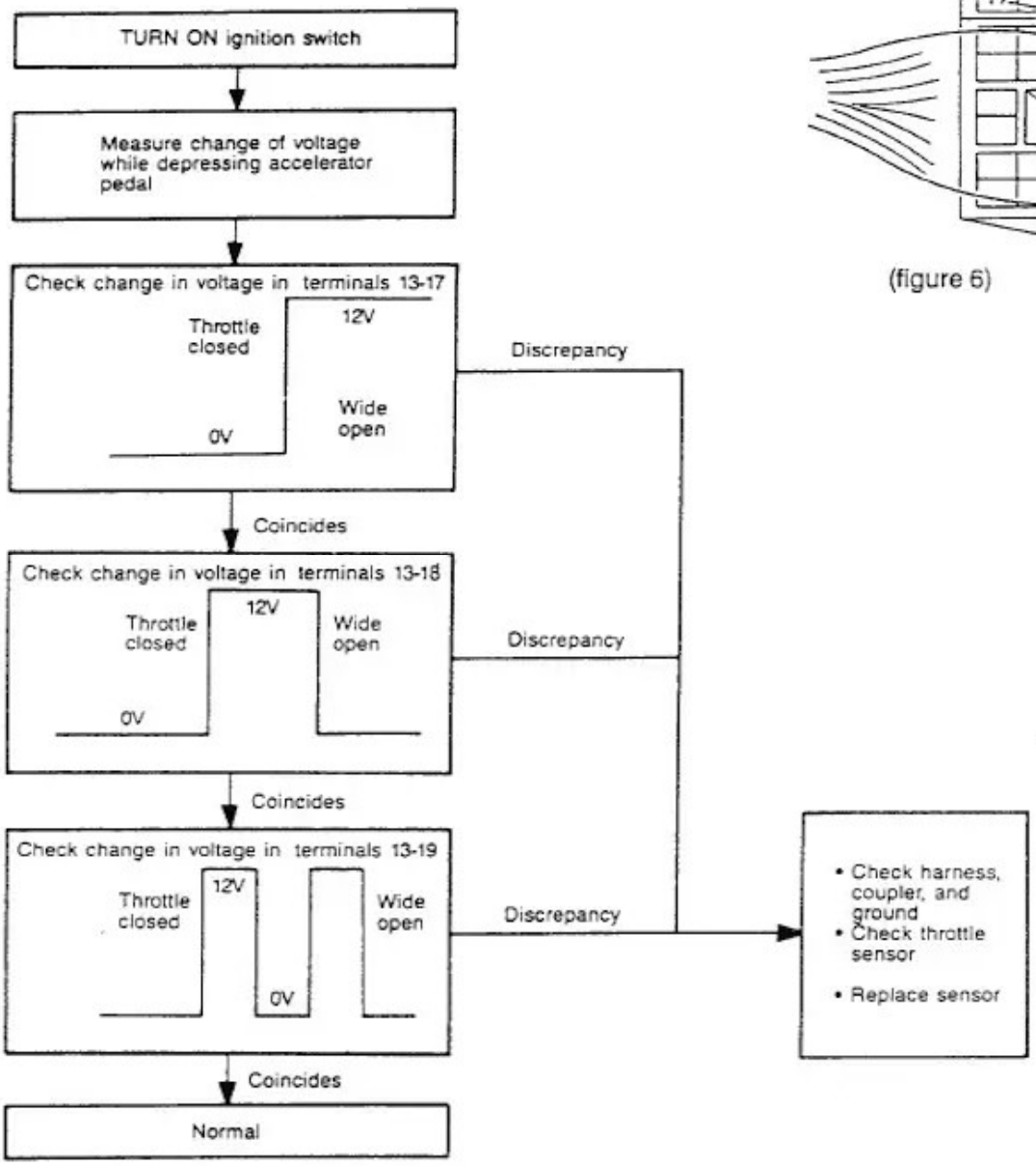
TERMINALS	CONDITION	RESISTANCE
Between A and B terminals (Idle Switch)	When throttle lever-to-stop screw clearance is 0.3 mm (0.012 in.)	0
	When throttle lever-to-stop screw clearance is 0.9 mm (0.035 in.)	Continuity
Between A and D terminals	Throttle valve is at idle position	4.37 - 8.13 k Ω
Between A and C terminals	Throttle valve is at idle position	240 - 1140 Ω
	Throttle valve is fully opened	3.17 - 6.6 k Ω

(figure 5)

The throttle position sensor can also be checked at the A/T control module harness plug with a voltmeter (figure 6 & 7).



(figure 6)



(Figure 7)